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JANUARY, 1890.

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PROFESSORS SIMONDS, BROWN AND AXE.

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Class Prizes are given in each division of the Student's Studies.

RICHARD A. N. POWYS, Secretary.

BOOKS, ETC., RECEIVED.

History and Pathology of Vaccination, Vols. I and II, by Edgar M. Crookshank, M.B., Professor of Comparative Pathology and Bacteriology in, and Fellow of, King's College, London, &c.

The Veterinary Surgeon's Diary and Note Book for 1890, by E. E. Bennett.

The following foreign publications are to hand:—*Annales de Medecine Vétérinaire*, December, 1889; *Oesterreichische Monatsschrift für Thierheilkunde, und Revue für Thierheilkunde und Thierzucht*, September, 1889; *Archivio per le Scienze Mediche, La Clinica Veterinaria* (Milan), November, 1889; *Giornale Veterinaria Militare*, No. 7; *Zeitschrift für Veterinärkunde mit besonderer Berücksichtigung der Hygiene*, Berlin, December, 1889; and *Journal of the National Agricultural Society of Victoria*, Vol. V, No. 49.

Papers received: *Mark Lane Express*, *North British Agriculturist*, *Land and Water*, *The Field*, *Live Stock Journal*, *Bell's Weekly Messenger*, *Agricultural Gazette*, *Farmers' Gazette*, Dublin; *Isle of Wight Observer and Chronicle*, *The Isle of Wight County Press*, *The Andover Observer*, *The Gazette*, Montreal; *The Evening Dispatch*, Edinburgh; *Macclesfield County Herald*, and *The Farm, Field, and Fireside*.

It is particularly requested that in future the British and Foreign Exchange Journals be directed to the Editor of the *Veterinarian*, 22½, Bartholomew Close, London, E.C.

NOTICE TO CORRESPONDENTS.

The result of the Scottish Examinations arrived too late for insertion in our present number, but will appear in our next.

To ensure the publication of Cases and Communications in the coming Number they should arrive by the 15th of the Month.

Letters, Reports of Cases, etc., may be directed either to Professor Simonds, J.P., Ryde, Isle of Wight, or to the "Editors," at the Royal Veterinary College, or to the care of Adlard & Son, printers, 22½, Bartholomew Close, London, E.C.

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VETERINARIAN.

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Communications and Cases.

NOTES ON "SURRA."

THE views entertained by R. W. Burke, A.V.D., who has given much attention to the pathology of this fatal disease among horses in India, would seem to show that it is essentially Pernicious Anæmia due to hæmatozoa, and that it is allied to a disease of horses in Germany, noticed by Fröhner and other writers,* who attribute that malady to the presence of a hæmatozoon.

It may be observed that Dr. Crookshank, of London, and Dr. T. R. Lewis, of Calcutta, have demonstrated the existence of the same parasite in the blood of healthy rats, and Dr. Evans in healthy as well as in diseased camels; so that the precise relation of the parasite to Surra does not appear quite clear, except that it is present in large numbers in every case of the equine disease, whereas about 25 per cent. only of the *healthy* rats show it in their blood. Similarly in regard to the behaviour of the *anchylostoma* to the Ceylon disease of human beings called *panduwa*, it has been noticed that the parasite was frequently present in the *post-mortem* examinations of animals that did not die of anæmia. Thus it is doubtful whether its presence invariably gives rise to anæmia with all its train of symptoms.†

One can hardly conceive that these organisms should exist in the blood, in any numbers, without affecting it prejudicially, though we know that they have been found in

* *Ueber perniciöse Anämie beim Pferde*, von Eugen Fröhner, Berlin, 1886.

† *Brit. Med. Journal*, June 30th, 1888.

the blood of animals which were apparently healthy. Of course it is difficult to define any absolute standard of perfect health, and there may be a considerable amount of cachexia, even in animals appearing to be quite healthy. What the peculiar change in locality or action on the part of the monads may be which determines the diseased condition, is one of the points that need elucidation. We naturally ask if there be any analogy in the behaviour of other parasites in this respect. Dracunculus may cause little or no trouble in the earlier stages, but developing, changing place, and discharging its embryos, the gravest results follow. Trichina, in its earlier stages, is comparatively unfelt, but may nevertheless become the cause of fatal disease.

The nature of the equine disease of India in which the parasites have been seen and hitherto known under the native name of *surra*, was not well understood until Burke asserted from a study of its clinical features that it was *pernicious anæmia* of the horse. The marked anæmia noted in Surra, the paroxysms of increase of temperature, the duration and course, and the extreme fatality—"invariably fatal" —together with the history of the parasites seen in the blood, form a group of conditions sufficiently diagnostic of pernicious anæmia. The leucocytosis, which is a marked feature of pernicious anæmia, is also characteristic of Surra, and which in typical cases is always present.

Finally, in regard to the classification of the parasite. Steel called it a spirillum and he tried to trace a relationship between the disease and relapsing fever of man, but this suggestion was shown to be incorrect by Dr. Cunningham, of Calcutta, who says: "The statement that the disease is closely related to human relapsing fever is certainly not supported by the thermometrical data, and the truly spirillar nature of the parasitic bodies has yet to be demonstrated." * Dr. Crookshank has since examined the parasite from a case of Surra, and suggests the name of *Trichomonas sanguinis*. Although this parasite is generally believed to be the cause of Surra, Dr. Crookshank† remarks that this is not yet positively proved.

Dr. Vandyke Carter, of Bombay, has shown that malarial fever in man is of the nature of hæmatozoic affections; and there is no doubt as to the presence of closely allied flagellated monads in the blood of horses suffering from Surra; yet in some animals the same parasites seem to exercise no

* *Veterinary Journal*, October, 1888.

† *Manual of Bacteriology*, 2nd edition, p. 350.

ill results whatever. A real difficulty lies in determining the relation of pathogenic and non-pathogenic hæmatozoa, and in tracing the distribution of those which play the rôle of general infectivity. But the fact of there being a difficulty to contend with in no way affects the question, What is the relation of hæmatozoa to infective diseases? We believe many of the fevers which show a paroxysmal tendency and may be seen commonly attacking animals will be found to be of this nature.

The Surra parasites enter the body of the host with food or water, and probably pass, as Mr. Burke says, by way of the bile-ducts into the blood. Be this as it may, having gained entry into the alimentary track, whether by means of the drinking water or along with the grass, &c., they migrate thence into the blood, which contains incredible numbers of them. The reception of the trichomonas, or its embryos, through sound skin is open to question.

The action of the Surra parasite has been described as that of tearing, dragging or tugging at the blood-corpuscles. Is the action of the *Strongylus armatus* any different on the mucous coat of the intestines and inner coat of the blood-vessels? The Surra parasite is believed to possess suctorial organs; but it probably absorbs its food by endosmosis through the body wall without any mouth at all. The parasites are transferred from one part of the body to another, along with the blood-current, by their wriggling movements, which are aided by the flagella.

[We have retained the pathological views, and much of the phraseology, of the author in these Notes.—Eds.]

ANTIFEBRIN AS A REMEDY FOR INFLUENZA.

By W. F. Barrett, M.R.C.V.S., London.

Having, during the past two months, been called upon to attend many horses suffering from influenza, of the peculiar type now so prevalent in London, and not having at first met with quite satisfactory results from the administration of the common febrifuge medicines, I determined to resort to more recently discovered drugs, with the hope of more successfully combating the disease. Knowing that antifebrin and antipyrin were commonly used in the medical profession, I decided, on account of its cheapness, and by reason of its having been said to be as efficacious as the latter, upon giving the former a trial.

Careful observations with regard to the action of antifebrin in influenza have convinced me that the drug is invaluable in this and other febrile affections, for not only is it capable of speedily reducing the temperature, but also of relieving those distressing symptoms so frequently associated with fever.

Whilst strongly advising the use of this drug, regard must be paid to the condition of the patient; more particularly the action of the heart must be noted, for although with moderate doses the pulse becomes feeble and less frequent, heavy doses sometimes appear to weaken the organ and depress the animal.

In those cases in which are present a feeble pulse, temperature not higher than 103°, much prostration, stiffness of limbs, &c., the agent should be given sparingly; say in a ball containing ʒiss every twelve hours. On the other hand, when the temperature is very high, with a fairly strong pulse, I give as much as ʒiss every six hours, as long as may be necessary. I have met with much success from the use of antifebrin aided by stimulants; to prove, however, that stimulants alone fail to produce the desired effect in all cases, I may say that, as shown below, the temperature remained persistently high till antifebrin was given, whereupon the decrease of the fever was most rapid and complete.

A few cases will clearly illustrate the specific action of this drug.

Case A.—Chestnut mare was seized with influenza on the 27th November, the temperature not rising above 103°, but remaining almost stationary till the evening of the 5th December, when it rose to 105°; there were also now well developed symptoms of bowel disturbance. A ball containing ʒiss of antifebrin was given every six hours. At 11 a.m. on the following day the temperature was 99·4°, and the mare was reported as feeding much better. The balls were now withheld; on the 7th the temperature rose to 102·4°, when a similar dose of the medicine was given. On the 8th it was normal.

Case B.—Bay cart-mare was taken ill on the 11th inst.; temperature 101·6°, pulse 70. A stimulant was given; at 8 p.m. on the 12th temperature stood at 105°, pulse 82, respiration quickened. An antifebrin ball and stimulant were given at 12 midnight; at 6 a.m. these were repeated. At 10 a.m. of the 13th temperature was normal and continued as such, the mare appearing much better generally.

Case C.—Bay cart-horse. December 5th, 10 a.m., temperature 105°, pulse 80, respiration 25. Antifebrin ball

with a stimulant given every twelve hours. On the 6th temperature 100·8°, pulse 42, respiration 12. Feeding well, recovered rapidly.

Case D.—Grey horse. 10 p.m., November 29th, temperature 104·8°, pulse 76, respiration slightly accelerated; gave antifebrin and stimulant. 30th, 9.30 a.m., temperature 101·6°, pulse 60; repeated medicine every twelve hours. 31st, 9.30 a.m., temperature 100·4; animal much better.

Case E.—Brown van-horse. November 29th, temperature 104°, pulse 62, respiration hurried; antifebrin ball and stimulant given. 30th, temperature 100·4°, pulse 50; animal rapidly recovering.

Reverting to Case A, which is, I think, especially interesting, it will be observed that the temperature stood at 103°, or thereabouts, from November 27th to December 5th, during which time stimulants only were given. On the frequent administration of antifebrin after the thermometer indicated 105° the temperature fell to 99·4° in sixteen hours, without the development of any unfavorable symptoms. Upon the discontinuance of the drug the temperature again rose to 102·5°, and rapidly fell on repeating the dose. Case B merely shows a fall of 5° in fourteen hours, notwithstanding that the temperature had rapidly risen and was associated with distressed symptoms which induced the owner to send for me hurriedly. The other cases show such a rapid fall of temperature that one is justified in giving much credit to the drug.

I desire to say I have used antifebrin in very many similar cases with every possible success, and I am strongly of opinion that the death rate may be perceptibly lowered by the careful administration of this medicine. I feel sure antifebrin will prove a useful remedy in cases of pneumonia, pleurisy, and specific affections; for from observations I have made I am convinced no harm results from the sudden fall of temperature, provided that the drug be discontinued when the normal standard has been attained.

It has often occurred to me that antifebrin may possess the power of preventing specific diseases, for one may reasonably infer that an agent which acts so powerfully upon an animal affected with fever will, when given during health, aid the animal powers in resisting the invasion of diseased germs. I hope to test further the action of this remedy upon healthy as well as diseased animals.

I feel I ought to acknowledge my indebtedness to my assistant, Mr. Perryman, M.R.C.V.S., for his help in procuring clinical facts and other assistance.

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This substance is a mixture of camphor chloral and oleic acid. It has been extensively used in the United States for allaying the horrible itching of pruritus ani, eczema, and many other skin affections, where the chief feature is to control the itching.

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Pathological Contributions.

PLEURO-PNEUMONIA.

In Great Britain during the four weeks ending December 14th, 22 fresh outbreaks of this disease were reported; 10 of them were in England, in the counties of Cumberland, Herts, Kent, Lancaster, Norfolk, and London. The 12 outbreaks in Scotland took place in Aberdeen, Ayr, Edinburgh, Forfar, Peebles, Renfrew, Selkirk, and Stirling.

The number of cattle attacked was 75, and 255 healthy animals in contact were slaughtered.

In Ireland 7 fresh outbreaks of pleuro-pneumonia were reported in the four weeks, 8 cattle were attacked, and 120 healthy ones exposed to infection were slaughtered.

ANTHRAX.

THERE were 20 outbreaks of anthrax reported in Great Britain, 15 of them in England, in the counties of Lincoln (Holland), Norfolk, Northampton, Notts, Somerset, Sussex (East), Warwick, Wilts, York (North), and West Riding. The 5 outbreaks in Scotland occurred in the counties of Edinburgh, Fife, Forfar, and Inverness.

The number of animals attacked was 30; 3 diseased animals were killed, 29 died, and 2 recovered.

SWINE FEVER.

THERE were 249 fresh outbreaks of this disease reported in Great Britain, and 1462 swine attacked. This is a very considerable decrease as compared with the returns for the corresponding period of last year when 400 outbreaks were reported, and 2602 swine attacked. Of the diseased pigs 707 were killed, 657 died, 124 recovered, and 285 remained alive at the end of the week.

RABIES.

IN England 20 cases were reported in the counties of Essex, Kent, Lancaster, London, Middlesex, Surrey, and York (West Riding).

In Ireland 16 cases of rabies were returned; 10 dogs, 4 cattle, 1 horse, and 1 pig.

THE VETERINARIAN, JANUARY 1, 1890.

Ne quid falsi dicere audeat, ne quid veri non audeat.—CICERO.

RABIES ORDER OF 1889.

MUZZLING as a means of checking the progress of rabies is condemned by the Dog Owners Society, and approved by the Society for the Prevention of Hydrophobia. Both sides advance arguments in support of their views. Such arguments were, in fact, advanced by the speaker at deputations from each society which were received by the President of the Board of Agriculture on Saturday, the 14th ultimo. In favour of the muzzle it is urged that rabies diminishes or ceases to exist when the use of the instrument is rigidly enforced. Against it the opponents contend, without denying that rabies diminishes under its use, that the main effect is due to its being a distinguishing mark, and thus enabling the authorities to seize and destroy stray dogs, *i. e.* dogs not having the mark of the muzzle to distinguish them from the ownerless wanderers, which it is admitted are the chief agents in spreading the disease.

In so many words the opponents say, "Insist on the use of a collar with the owner's name and address engraved thereon, and a medal attached on which the number of the licence is stamped, and you at once, by a simple means, get all the effect of the muzzle. You mark your dog and separate him from the vagrant animal, relegating the latter to the tender mercies of the law, which demands his destruction for the public safety."

Muzzling, say the opponents, is of no use by itself, because the rabid dog is not muzzled, or if he is he will tear the engine off in his fury, and in any case he can bite when he is muzzled, as common observation proves. In reply to all this it may be objected that too much is assumed and not enough proved, and the chief objection seems to point to the use of ineffectual muzzles, or to the disuse of them where they are most required. What seems to be wanted is not less muzzling but more.

Taking for the moment all the statements which have been made by the opponents to the muzzle as absolutely true and unassailable, we may ask are they not offered to the wrong departments. The Board of Agriculture is the authority now charged with the administration of the Contagious Diseases (Animals) Acts, and it is the duty of the authority to adopt measures to check the spreading of contagious diseases. Dogs are subject to a fatal contagious disease, which they communicate to other animals by biting them, and in no other way. To answer the question how to prevent dogs from transmitting the virus of rabies is not difficult; in fact, the only answer which can be given is—prevent them from biting. The direct means of attaining this object are not many; in fact, there seems to be no choice between the two plans of rendering the teeth harmless by filing them flat, as a French authority suggests, or so hampering the dog's mouth that he cannot use them as inoculating instruments.

Strict insistence in registration, licensing, and the wearing of badges for the purpose of identification, are most desirable; but all these are measures which are obviously for the adoption of the Inland Revenue, and although they indirectly reduce the number of cases of disease among dogs by causing the destruction of the dogs themselves, they can hardly be advocated as legitimate means of arresting the spreading of disease; and it is certainly doubtful if the Contagious Diseases (Animals) Acts give any power to the executive to enforce them.

Muzzling in such a way as to prevent a dog from biting, as the Order provides, may be defended on the ground that as a means of preventing disease it is in strict accordance with the spirit of the Acts referred to. That muzzles are often improperly fitted, and useless for the intended purpose, cannot be denied; but this is only admitting that dog owners go out of their way to evade the law, not always with impunity, because in every case which has come under our notice of legal proceedings against owners of dogs for using an ineffectual muzzle a conviction has been obtained.

Many members of the veterinary profession object to the

muzzle as useless. Some say that it aids in spreading the disease. It would be interesting to know on what evidence these views are based, and what other means within the scope of the Contagious Diseases (Animals) Acts can be adopted by the executive.

Our readers will learn with satisfaction that Professor Simonds has been appointed a Justice of Peace for the Borough of Ryde.

Extracts from British and Foreign Journals.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—NEWCASTLE-UPON-TYNE, 1889.

Address by Professor W. H. Flower, C.B., LL.D., F.R.S., F.R.C.S., Pres.Z.S., F.L.S., F.G.S., President.

(*Continued from vol.* lxii, *p.* 705.)

Notwithstanding the multiplication of public museums during the present century, and the greater resources and advantages which many of these possess, which private collectors cannot command, the spirit of accumulation in individuals has happily not passed away, although usually directed into rather different channels than formerly. The general museums or miscellaneous collections of old are now left to governments and institutions which afford greater guarantee of their permanence and public utility, while admirable service is done to science by those private persons with leisure and means who, devoting themselves to some special subject, amass the materials by which its study can be pursued in detail either by themselves or by those they know to be qualified to do so; which collections, if they fulfil their most appropriate destiny, ultimately become incorporated, by gift or purchase, in one or other of the public museums, and then serve as permanent factors in the education of the nation, or rather of the world.

It would be passing beyond the limits of time allotted to this address, indeed going beyond the scope of the Association, if I were to speak of many of the subjects which have pre-eminently exercised the faculties of the collector and formed the materials of which museums are constructed. The various methods by which the mind of man has been able to reproduce the forms of natural objects or to give expression to the images created by his own fancy, from the

rudest scratchings of a savage on a bone, or the simplest arrangement of lines employed in ornamenting the roughest piece of pottery, up to the most lovely combinations of form and colour hitherto attained in sculpture or in painting, or in works in metal or in clay, depend altogether on museums for their preservation, for our knowledge of their condition and history in the past, and for the lessons which they can convey for the future.

Apart from the delight which the contemplation of the noblest expressions of art must produce in all cultivated minds, apart also from the curiosity and interest that must be excited by all the less successfully executed attempts to produce similar results, as materials for constructing the true history of the life of man, at different stages of civilisation, in different circumstances of living, and in divers regions of the earth, such collections are absolutely invaluable.

But I must pass them by in order to dwell more in detail upon those which specially concern the advancement of the subjects which come under the notice of this Association—museums devoted to the so-called "natural history" sciences, although much which will be said of them will doubtless be more or less applicable to museums in general.

The terms "natural history" and "naturalist" have become deeply rooted in our language, but without any very definite conception of their meaning or the scope of their application. Originally applied to the study of all the phenomena of the universe which are independent of the agency of man, natural history has gradually narrowed down in most people's minds, in consequence of the invention of convenient and generally understood and accepted terms for some of its various subdivisions, as astronomy, chemistry, geology, &c., into that portion of the subject which treats of the history of creatures endowed with life, for which, until lately, no special name had been invented. Even from this limitation botany was gradually disassociating itself in many quarters, and a "naturalist" and a "zoologist" have nearly become, however irrationally, synonymous terms. The happy introduction and general acceptance of the word "biology," notwithstanding the objections raised to its etymological signification, have reunited the study of organisms distinguished by the possession of the living principle, and practically eliminated the now vague and indefinite term "natural history" from scientific terminology. As, however, it is certain to maintain its hold in popular language, I would venture to suggest the desirability of restoring it to its original and really definite signi-

fication, contrasting it with the history of man and of his works, and of the changes which have been wrought in the universe by his intervention.

It was in this sense that, when the rapid growth of the miscellaneous collections in the British Museum at Bloomsbury (the expansion of Sir Hans Sloane's accumulation in the old Manor House at Chelsea) was thought to render a division necessary, the line of severance was effected at the junction of what was natural and what was artificial; the former, including the products of what are commonly called "natural" forces, unaffected by man's handiwork, or the impress of his mind. The departments which took cognisance of these were termed the "Natural History Departments," and the new building to which they were removed the "Natural History Museum."

It may be worth while to spend a few moments upon the consideration of the value of this division, as it is one which concerns the arrangement and administration of the majority of museums.

Though there is very much to be said for it, the objection has been raised that it cuts man himself in two. The illustrations of man's bodily structure are undoubtedly subjects for the zoologist. The subtile gradations of form, proportion, and colour which distinguish the different races of men, can only be appreciated by one with the education of an anatomist, and whose eye has been trained to estimate the value of such characters in discriminating the variations of animal forms. The subjects for comparison required for this branch of research must therefore be looked for in the zoological collections.

But the comparatively new science of "anthropology" embraces not only man's physical structure: it includes his mental development, his manners, customs, traditions, and languages. The illustrations of his works of art, domestic utensils, and weapons of war are essential parts of its study. In fact it is impossible to say where it ends. It includes all that man is or ever has been, all that he has ever done. No definite line can be drawn between the rudest flint weapon and the most exquisitely finished instrument of destruction which has ever been turned out from the manufactory at Elswick, between the rough representation of a mammoth, carved by one of its contemporary men on a portion of its own tusk, and the most admirable production of a Landseer. An anthropological collection, to be logical, must include all that is in not only the old British Museum, but the South Kensington Museum and the National Gallery. The notion

of an anthropology which considers savages and pre-historic people as apart from the rest of mankind may, in the limitations of human powers, have certain conveniences, but it is utterly unscientific and loses sight of the great value of the study in tracing the gradual growth of our complex systems and customs from the primitive ways of our progenitors.

On the other hand, the division first indicated is as perfectly definite, logical, and scientific as any such division can be. That there are many inconveniences attending wide local disjunctions of the collections containing subjects so distinct yet so nearly allied as physical and psychical anthropology must be fully admitted; but these could only have been overcome by embracing in one grand institution the various national collections illustrating the different branches of science and art, placed in such order and juxtaposition that their mutual relations might be apparent, and the resources of each might be brought to bear upon the elucidation of all the others—an ideal institution, such as the world has not yet seen, but into which the old British Museum might at one time have been developed.

A purely "Natural History Museum" will then embrace a collection of objects illustrating the natural productions of the earth, and in its widest and truest sense should include, as far as they can be illustrated by museum specimens, all the sciences which deal with natural phenomena. It has only been the difficulties, real or imaginary, in illustrating them which have excluded such subjects as astronomy, physics, chemistry, and physiology from occupying departments in our National Natural History Museum, while allowing the introduction of their sister sciences, mineralogy, geology, botany, and zoology.

Though the experimental sciences and those which deal with the laws which govern the universe, rather than with the materials of which it is composed, have not hitherto greatly called forth the collector's instinct, or depended upon museums for their illustration, yet the great advantages of collections of the various instruments by means of which these sciences are pursued, and of examples of the methods by which they are taught, are yearly becoming more manifest. Museums of scientific apparatus now form portions of every well-equipped educational establishment, and under the auspices of the Science and Art Department at South Kensington a national collection illustrating those branches of natural history science which have escaped recognition in the British Museum is assuming a magnitude and importance

which brings the question of properly housing and displaying it urgently to the front.

Anomalies such as these are certain to occur in the present almost infantile though rapidly progressive state of science. It may be taken for granted that no scientific institution of any complexity of organisation can be, except at the moment of its birth, abreast of the most modern views of the subject, especially in the dividing lines between, and the proportional representation of, the various branches of knowledge which it includes.

The necessity for subdivisions in the study of science is continually becoming more apparent as the knowledge of the details of each subject multiplies without corresponding increase in the power of the human mind to grasp and deal with them, and the dividing lines not only become sharper, but as knowledge advances they frequently require revision. It might be supposed that such revision would adjust itself to the direction taken by the natural development of the relations of the different branches of science, and the truer conceptions entertained of such relations. But this is not always so. Artificial barriers are continually being raised to keep these dividing lines in the direction in which they have once started. Difficulties of readjustment arise not only from the mechanical obstacles caused by the size and arrangements of the buildings and facilities for the allocation of various kinds of collections, but still more from the numerous personal interests which grow up and wind their meshes around such institutions. Professorships and curatorships of this or that division of science are founded and endowed, and their holders are usually tenacious either of encroachment upon or of any wide enlargement of the boundaries of the subject they have undertaken to teach or to illustrate; and in this way, more than any other, passing phases of scientific knowledge have become crystallised or fossilised in institutions where they might least have been expected. I may instance many European universities and great museums in which zoology and comparative anatomy are still held to be distinct subjects taught by different professors, and where, in consequence of the division of the collections under their charge, the skin of an animal, illustrating its zoology, and its skeleton and teeth, illustrating its anatomy, must be looked for in different and perhaps remotely placed buildings.

For the perpetuation of the unfortunate separation of palæontology from biology, which is so clearly a survival of an ancient condition of scientific culture, and for the main-

tenance in its integrity of the heterogeneous compound of sciences which we now call "geology," the faulty organisation of our museums is in a great measure responsible. The more their rearrangement can be made to overstep and break down the abrupt line of demarcation which is still almost universally drawn between beings which live now and those which have lived in past times, so deeply rooted in the popular mind and so hard to eradicate even in that of the scientific student, the better it will be for the progress of sound biological knowledge.

But it is not of the removal of such great anomalies and inconsistencies which, when they have once grown up, require heroic methods to set them right, but rather of certain minor defects in the organisation of almost all existing museums which are well within the capacity of comparatively modest administrative means to remedy, that I have now to speak.

That great improvements have been lately effected in many respects in some of the museums in this country, on the Continent, and especially in America, no one can deny. The subject, as I have already indicated, is, happily, exciting the attention of those who have the direction of them, and even awakening interest in the mind of the general public. It is in the hope of in some measure helping on or guiding this movement that I have ventured on the remarks which follow.

The first consideration in establishing a museum, large or small, either in a town, institution, society, or school, is that it should have some definite object or purpose to fulfil; and the next is that means should be forthcoming, not only to establish, but also to maintain the museum in a suitable manner to fulfil that purpose. Some persons are enthusiastic enough to think that a museum is in itself so good an object that they have only to provide a building and cases and a certain number of specimens, no matter exactly what, to fill them and then the thing is done; whereas the truth is the work has only then begun. What a museum really depends upon for its success and usefulness is not its building, nor its cases, nor even its specimens, but its curator. He and his staff are the life and soul of the institution, upon whom its whole value depends; and yet in many—I may say most of our museums—they are the last to be thought of. The care, the preservation, the naming of the specimens are either left to voluntary effort—excellent often for special collections and for a limited time, but never to be depended on as a permanent arrangement—or a grievously under-

salaried and consequently uneducated official is expected to keep in order, to clean, dust, arrange, name, and display in a manner which will contribute to the advancement of scientific knowledge, collections ranging in extent over almost every branch of human learning, from the contents of an ancient British barrow to the last discovered bird of paradise from New Guinea.

Valuable specimens not unfrequently find their way into museums thus managed. Their public-spirited owners fondly imagine that they will be preserved and made of use to the world if once given to such an institution. Their fate is, unfortunately, far otherwise. Dirty, neglected, without label, their identity lost, they are often finally devoured by insects or cleared away to make room on the crowded shelves for the new donation of some fresh patron of the institution. It would be far better that such museums should never be founded. They are traps into which precious —sometimes priceless—objects fall only to be destroyed; and, what is still worse, they bring discredit on all similar institutions, make the very name of museum a byword and a reproach, hindering instead of advancing the recognition of their value as agents in the great educational movement of the age.

A museum is like a living organism—it requires continual and tender care. It must grow or it will perish; and the cost and labour required to maintain it in a state of vitality is not yet by any means fully realised or provided for, either in our great national establishments or in our smaller local institutions.

Often as it has been said, it cannot be too often repeated, that the real objects of forming collections, of whatever kind (apart, of course, from the mere pleasure of acquisition—sometimes the only motive of private collectors), and which, although in very different degrees, and often without being recognised, underlie the organisation of all museums, are two, which are quite distinct, and sometimes even conflicting. The first is to advance or increase the knowledge of some given subject. This is generally the motive of the individual collector, whose experience shows him the vast assistance in forming definite ideas in any line of research in which he may be occupied that may be derived from having the materials for its study at his own command, to hold and to handle, to examine and compare, to take up and lay aside whenever the favorable moment to do so occurs. But unless his subject is a very limited one, or his means the reverse, he soon finds the necessity of consulting collec-

tions based on a larger scale than his own. Very few people have any idea of the multiplicity of specimens required for the purpose of working out many of the simplest problems concerning the life-history of animals or plants. The naturalist has frequently to ransack all the museums, both public and private, of Europe and America in the endeavour to compose a monograph of a single common genus, or even species, that shall include all questions of its variation, changes in different seasons, and under different climates and conditions of existence, and the distribution in space and time of all its modifications. He often has to confess at the end that he has been baffled in his research for want of the requisite materials for such an undertaking. Of course this ought not to be, and the time will come when it will not be, but that time is very far off yet.

We all know the old saying, that the craving for riches grows as the wealth itself increases. Something similar is true of scientific collections brought together for the purpose of advancing knowledge. The larger they are the more their deficiencies seem to become conspicuous; the more desirous we are to fill up the gaps which provokingly interfere with our extracting from them the complete story they have to tell.

Such collections are, however, only for the advanced student, the man who has already become acquainted with the elements of his science and is in a position, by his knowledge, by his training, and by his observing and reasoning capacity to take advantage of such material to carry on the subject to a point beyond that at which he takes it up.

But there is another and a far larger class to whom museums are or should be a powerful means of aid in acquiring knowledge. Among such those who are commencing more serious studies may be included; but I especially refer to the much more numerous class, and one which it may be hoped will year by year bear a greater relative proportion to the general population of the country, who, without having the time, the opportunities, or the abilities to make a profound study of any branch of science, yet take a general interest in its progress, and wish to possess some knowledge of the world around them and of the principal facts ascertained with regard to it, or at least some portions of it. For such persons museums may be, when well organised and arranged, of benefit to a degree that at present can scarcely be realised.

To diffuse knowledge among persons of this class is the second of the two purposes of museums of which I have spoken.

I believe that the main cause of what may be fairly termed the failure of the majority of museums—especially museums of natural history—to perform the functions that might be legitimately expected of them is that they nearly always confound together the two distinct objects which they may fulfil, and by attempting to combine both in the same exhibition practically accomplish neither.

In accordance with which of those two objects, which may be briefly called *research* and *instruction*, is the main end of the museum, so should the whole be primarily arranged; and in accordance with the object for which each specimen is required, so should it be treated.

The specimens kept for research, for advancement of knowledge, for careful investigations in structure and development, or for showing the minute distinctions which must be studied in working out the problems connected with variations of species according to age, sex, season, or locality; for fixing the limits of geographical distribution, or determining the range in geological time, must be not only exceedingly numerous (so numerous, indeed, that it is almost impossible to put a limit on what may be required for such purposes), but they must also be kept under such conditions as to admit of ready and close examination and comparison.

If the whole of the specimens really required for enlarging the boundaries of zoological or botanical science were to be displayed in such a manner that each one could be distinctly seen by any visitor sauntering through the public galleries of a museum, the vastness and expense of the institution would be out of all proportion to its utility; the specimens themselves would be quite inaccessible to the examination of all those capable of deriving instruction from them, and, owing to the injurious effects of continued exposure to light upon the greater number of preserved natural objects, would ultimately lose a large part of their permanent value. Collections of this kind must, in fact, be treated as the books in a library, and be used only for consultation and reference by those who are able to read and appreciate their contents. To demand, as has been ignorantly done, that all the specimens belonging to our national museums, for instance, should be displayed in cases in the public galleries, would be equivalent to asking that every book in a library, instead of being shut up and arranged on shelves for consultation when required, should have every single page framed and glazed and hung on the walls, so that the humblest visitor as he passes along the galleries has only to open his eyes and

revel in the wealth of literature of all ages and all countries, without so much as applying to a custodian to open a case. Such an arrangement is perfectly conceivable. The idea from some points of view is magnificent, almost sublime. But imagine the space required for such an arrangement of the national library of books, or, indeed, of any of the smallest local libraries; imagine the inconvenience to the real student, the disadvantages which he would be under in reading the pages of any work fixed in an immovable position beneath a glass case; think of the enormous distances he would often have to traverse to compare a reference or verify a quotation, and the idea of sublimity soon gives place to its usual antithesis. The attempt to display every bird, every insect, shell, or plant which is or ought to be in any of our great museums of reference would produce an exactly similar result.

In the arrangement of collections designed for research which, of course, will contain all those precious specimens called 'types,' which must be appealed to through all time to determine the species to which a name was originally given, the principal points to be aimed at are—the preservation of the objects from all influences deleterious to them, especially dust, light, and damp; their absolutely correct identification, and record of every circumstance that need be known of their history; their classification and storage in such a manner that each one can be found without difficulty or loss of time; and, both on account of expense as well as convenience of access, they should be made to occupy as small a place as compatible with these requirements. They should be kept in rooms provided with suitable tables and good light for their examination, and within reach of the necessary books of reference on the particular subjects which the specimens illustrate. Furthermore, the rooms should be so situated that the officers of the museum, without too great hindrance to their own work, can be at hand for occasional assistance and supervision of the student, and if collections of research and exhibited specimens are contained in one building, it is obvious that the closer the contiguity in which those of any particular group are placed the greater will be the convenience both of students and curators, for in very few establishments will it be possible to form each series on such a scale as to be entirely independent of the other.

On the other hand, in a collection arranged for the instruction of the general visitor, the conditions under which the specimens are kept should be totally different. In the first place, their numbers must be strictly limited, according

to the nature of the subject to be illustrated and the space available. None must be placed too high or too low for ready examination. There must be no crowding of specimens one behind the other, every one being perfectly and distinctly seen, and with a clear space around it. Imagine a picture-gallery with half the pictures on the walls partially or entirely concealed by others hung in front of them; the idea seems preposterous, and yet this is the approved arrangement of specimens in most public museums. If an object is worth putting into a gallery at all it is worth such a position as will enable it to be seen. Every specimen exhibited should be good of its kind, and all available skill and care should be spent upon its preservation and rendering it capable of teaching the lesson it is intended to convey. And here I cannot refrain from saying a word upon the sadly neglected art of taxidermy, which continues to fill the cases of most of our museums with wretched and repulsive caricatures of mammals and birds, out of all natural proportions, shrunken here and bloated there, and in attitudes absolutely impossible for the creature to have assumed while alive. Happily there may be seen occasionally, especially where amateurs of artistic taste and good knowledge of natural history have devoted themselves to the subject, examples enough—and you are fortunate in possessing them in Newcastle—to show that an animal can be converted after death, by a proper application of taxidermy, into a real life-like representation of the original, perfect in form, proportions, and attitude, and almost, if not quite, as valuable for conveying information on these points as the living creature itself. The fact is that taxidermy is an art resembling that of the painter, or rather the sculptor; it requires natural genius as well as great cultivation, and it can never be permanently improved until we have abandoned the present conventional low standard and low payment for "bird-stuffing," which is utterly inadequate to induce any man of capacity to devote himself to it as a profession.

To return from this digression, every specimen exhibited should have its definite purpose, and no absolute duplicate should on any account be permitted. Above all, the purpose for which each specimen is exhibited, and the main lesson to be derived from it, must be distinctly indicated by the labels affixed, both as headings of the various divisions of the series, and to the individual specimens. A well-arranged educational museum has been defined as a collection of instructive labels illustrated by well-selected specimens.

What is, or should be, the order of events in arranging a portion of a public museum? Not, certainly, as too often happens now, bringing a number of specimens together almost by haphazard, and cramming them as closely as possible in a case far too small to hold them, and with little reference to their order or to the possibility of their being distinctly seen. First, as I said before, you must have your curator. He must carefully consider the object of the museum, the class and capacities of the persons for whose instruction it is founded, and the space available to carry out this object. He will then divide the subject to be illustrated into groups, and consider their relative proportions, according to which he will plan out the space. Large labels will next be prepared for the principal headings, as the chapters of a book, and smaller ones for the various subdivisions. Certain propositions to be illustrated, either in the structure, classification, geographical distribution, geological position, habits, or evolution of the subjects dealt with, will be laid down and reduced to definite and concise language. Lastly will come the illustrative specimens, each of which as procured and prepared will fall into its appropriate place. As it is not always easy to obtain these at the time that they are wanted, gaps will often have to be left, but these, if properly utilised by drawings or labels, may be made nearly as useful as if occupied by the actual specimens

A public exhibition which is intended to be instructive and interesting must never be crowded. There is, indeed, no reason why it ever should be. Every such exhibition, whether on a large or small scale, can only contain a representative series of specimens, selected with a view to the needs of the particular class of persons who are likely to visit the gallery, and the number of specimens exhibited should be adapted to the space available. There is, therefore, rarely any excuse for filling it up in such a manner as to interfere with the full view of every specimen shown. A crowded gallery, except in some very exceptional circumstances, at once condemns the curator, as the remedy is generally in his own hands. In order to avoid it he has nothing to do but sternly to eliminate all the less important specimens. If any of these possess features of historical or scientific interest demanding their permanent preservation, they should be kept in the reserve collections; if otherwise, they should not be kept at all.

The ideal public museums of the future will, however, require far more exhibition space than has hitherto been

allowed; for though the number of specimens shown may be fewer than is often thought necessary now, each will require more room if the conditions above described are carried out, and especially if it is thought desirable to show it in such a manner as to enable the visitor to realise something of the wonderful complexity of the adaptations which bring each species into harmonious relation with its surroundtng conditions. Artistic reproductions of natural environments, illustrations of protective resemblances, or of special modes of life, all require much room for their display. This method of exhibition, wherever faithfully carried out, is, however, proving both instructive and attractive, and will doubtless be greatly extended.

Guide-books and catalogues are useful adjuncts, as being adapted to convey fuller information than labels, and as they can be taken away for study during the intervals of visits to the museum, but they can never supersede the use of labels. Anyone who is in the habit of visiting picture-galleries where the names of the artists and the subject are affixed to the frame, and others in which the information has in each case to be sought by reference to a catalogue, must appreciate the vast superiority in comfort and time-saving of the former plan.

Acting upon such principles as these, every public gallery of a museum, whether the splendid saloon of a national institution or the humble room containing the local collection of a village club, can be made a centre of instruction, and will offer interests and attractions which will be looked for in vain in the majority of such institutions at the present time.

One of the best illustrations of the different treatment of collections intended for research or advancement of knowledge, and for popular instruction or diffusion of knowledge, is now to be seen in Kew Gardens, where the admirably constructed and arranged herbarium answers the first purpose, and the public museums of economic botany the second. A similar distinction is carried out in the collections of systematic botany in the natural history branch of the British Museum, with the additional advantage of close contiguity; indeed, as an example of a scheme of good museum arrangement (although not perfect yet in details) I cannot do better than refer to the upper storey, of the east wing of that institution. The same principles, little regarded in former times in this country, and still unknown in some of the largest continental museums, are gradually pervading every department of the institution, which, from its national

character, its metropolitan position, and exceptional resources, ought to illustrate in perfection the ideal of a natural history museum. In fact, it is only in a national institution that an exhaustive research collection in all branches of natural history, in which the specialist of every group can find his own subject fully illustrated, can or ought to be attempted.

As the actual comparison of specimen with specimen is the basis of zoological and botanical research, and as work done with imperfect materials is necessarily imperfect in itself, it is far the wisest policy to concentrate in a few great central institutions, the number and situation of which must be determined by the population and the resources of the country, all the collections, especially those containing specimens already alluded to as so dear to the systematic naturalist, known as author's "types," required for original investigations. It is far more advantageous to the investigator to go to such a collection and take up his temporary abode there, while his research is being carried out, with all the material required at his hand at once, than to travel from place to place and pick up piecemeal the information he requires, without opportunity of direct comparison of specimens.

I do not say that collections for special study, and even original research, should not, under particular circumstances and limitations, be formed at museums other than central national institutions, or that nothing should be retained in provincial museums but what is of a directly educational or elementary nature. A local collection, illustrating the fauna and flora of the district, should be part of every such museum; and this may be carried to almost any amount of detail, and therefore in many cases it would be very unadvisable to exhibit the whole of it. A selection of the most important objects may be shown under the conditions described above, and the remainder carefully preserved in cabinets for the study of specialists.

It is also very desirable in all museums, in order that the exhibited series should be as little disturbed as possible in arrangement, and be always available for the purpose for which it is intended, that there should be, for the use of teachers and students, a supplementary set of common objects, which, if injured, could be easily replaced.

(*To be continued.*)

THE THERAPEUTIC VALUE OF OXYGEN INHALATION.

By W. Gilman Thompson, M.D., Professor of Physiology in the New York University Medical College, Physician to the Presbyterian and New York Hospitals.

(*Continued from vol.* lxii, *p.* 707.)

It is possible that slight variations in the composition of the plasma may influence to a small degree the amount of oxygen absorbed. The change in temperature of oxygen on entering the lungs, even under compression, is not sufficient to materially affect the rate of absorption. The density of the membranes—namely, the epithelium of the air-cells, and especially the walls of the pulmonary capillaries—may conceivably vary with the amount of blood present, and influence the gas absorption.

In some of the older text-books of physiology the statement is made that animals cannot live in an atmosphere of pure oxygen, because it rapidly burns up their tissues as it burns a candle; *i.e.*, their greatly increased metabolism causes rapid tissue waste, convulsions, and death. This is a still prevalent popular fallacy. Later experimenters have claimed that the convulsions, &c., were due to retention of CO_2 and other waste products (possibly volatile ptomaïnes), which are re-inhaled. Dr. Andrew H. Smith showed, by a series of most instructive and exhaustive experiments, made in 1869–70, that so long as the exhaled CO_2 and nitrogenous waste are removed, animals live for many hours in pure oxygen under ordinary atmospheric pressure, without any symptoms or appreciable change.

I have repeated many similar experiments, and demonstrated that the same is true with regard to inhalation of oxygen under pressure not exceeding $1\frac{1}{2}$ or 2 atmospheres. Beyond this pressure the mechanical effects upon the circulation and the interference with proper gas diffusion in the lungs become manifest late or soon, according to the degree of pressure employed.

The only effects experienced by those in health who have inhaled oxygen freely are vague and inconstant, and many of these effects may be due to the gas not being absolutely pure. Some describe a sensation of freedom about the chest, as if respiration were easier, or they speak of a feeling of warmth beneath the sternum, or of coolness, slight vertigo, warm hands and feet. More blood flows to the surface of the body sometimes, and there may be slight formication. Some incline to drowsiness, others to increased muscular activity. There is often increased appetite and consequent

gain in weight. The pulse may or may not be accelerated. The temperature is usually unaltered. Uric acid is said to be diminished (Kohlmann and Eckard). I have sometimes noticed an increase in the rate of breathing while inhaling pure oxygen, but this has always been due to voluntary suction effort on the part of the patient, and it can be easily avoided by giving proper instructions.

Several deep voluntary inspirations of oxygen produce the condition known as apnœa, in which the breath can be held for several seconds longer than usual without discomfort. An interesting fact has been demonstrated by Bert, that, under an air-pump, animals can withstand a greater reduction of pressure in an atmosphere of pure rarefied oxygen than in an atmosphere of rarefied air. Quinquaud describes uniform reduction of the pulse in animals inhaling pure oxygen amounting to from 10 to 15 beats, and a corresponding reduction of 4 or 5 respirations, and ½—1° C. reduction in temperature. Bert found increased sugar in the blood of animals kept under increased oxygen pressure. From the foregoing summary of the physics of oxygen absorption it appears that, under given conditions of healthful circulation and respiration, but very little additional oxygen can be made to enter the blood by any degree of pressure short of that which mechanically interferes with those functions. In confirmation of this statement, and before considering the effect of oxygen upon abnormal circulation and respiration, I will cite a few of the experiments recently made.

The apparatus used for these experiments, which was made for me by the Delamater Iron Works in this city, is of very simple construction. It consists of an iron locomotive cylinder with one removable head. A window of half-inch plate-glass is inserted in either end of the cylinder, so that the animals can be constantly observed. A steam-gauge records the pressure of the gas, which is admitted through a valve connected by a strong tube with an ordinary oxygen cylinder, purchased from the oxygen manufacturer. The oxygen in these cylinders is sold under a pressure of 225 pounds or more, and as the cylinders are approximately the size of my own tank (36,700 ccm.), I readily get a pressure of 100 pounds by simply opening the valve. The tank has an exhaust valve for quickly releasing the pressure. It is painted white within, and furnished with an electric light. A wire grating is arranged to keep the animal off the floor, and allow room for urine, and for materials used to absorb waste products. Food can be put in, and the animal may

be left comfortable for any desired period. The exhalations may be tested at any time by collecting a little of the air from the exhaust valve. The removable head is so large that a good-sized dog can be put in through the opening. It is screwed on by many bolts, and leakage is prevented by rubber packing and red-lead. The apparatus is practically air-tight, for all the pressures at which I have used it. The character of the breathing, tracheal *râles*, cries, &c., can be very well auscultated through the iron wall of the tank and dense air within.

(Many interesting details of the following experiments are omitted for the sake of brevity.)

Experiment 1.—Two pigeons and a monkey were together placed in the tank and oxygen was added, 5 pounds at a time, at intervals of five minutes, until 30 pounds were reached, *i. e.* 2 atmospheres of oxygen + 1 of air already present—3 atmospheres in all. Up to this pressure no effect at all was produced except that the pigeons seemed drowsy, while the monkey was lively and playful. The monkey then showed moderate dyspnœa with mouth-breathing, and respiration rose from 35 to 70. The oxygen pressure was raised to 35 pounds, and in five minutes the monkey had a slight convulsion. The pigeons remained unaffected.

The pressure was gradually blown off, the convulsions ceased, and after remaining forty-five minutes in the tank the animals were released and appeared normal. The monkey's temperature had fallen $1\frac{1}{2}^{\circ}$ F. The temperature of one pigeon fell $4\frac{1}{2}^{\circ}$ F.; that of the other 6° F. No evacuation of urine or fæces. Hæmoglobin normal.

This experiment merely shows what has been demonstrated by others, that animals can exist comfortably in an atmosphere composed of more than two thirds oxygen, under moderately increased pressure, without any discernible alteration in their functions or demeanour, until the pressure exceeds 3 atmospheres.

Experiment 2.—A second monkey was kept in the tank for one hour and a quarter under 11 pounds of additional oxygen pressure. No effect, except that he appeared sleepy and rather bored. On removal the rectal temperature had fallen $1\frac{1}{2}^{\circ}$ F. As the tank air was blown off a pigeon was placed in the jar of it, and in six minutes it had convulsions, although a candle burned brightly in the same jar. A counter test was made by placing another pigeon in fresh air in another jar of the same size. In the same time, six minutes, the second pigeon had no dyspnœa, yet a candle was extinguished at once in the jar.

The fact that the first pigeon had a convulsion in an atmosphere that relighted a taper, is probably due to poisoning from the monkey's nitrogenous waste.

Experiment 3.—A guinea-pig, a dog, and an alligator were together placed in the tank, and oxygen was rapidly added, until in fifteen minutes a total pressure of 5 atmospheres was reached. The dog then had a convulsion. The pressure was released slowly, and after forty minutes it registered 20 pounds. The animals all seemed comfortable, so oxygen was added again up to 45 pounds, or 4 atmospheres in all. After a few minutes the valve was slowly opened and the animals were released, having remained one hour and a half in the tank. The pig and dog both died in three minutes in convulsions. Autopsies showed great pulmonary congestion in both animals, and over-distension of the right heart. The other viscera were exsanguinated. The venous blood was nearly black. The dog's temperature had fallen 9° F., and the pig's 14° F. The alligator's rose from $51\frac{1}{4}°$ (external air 66°) to 75°, or $23\frac{3}{4}°$ F. The alligator survived.

This experiment, with several others, shows that the higher animals are sooner affected by pressure than the lower. The monkey was asphyxiated before the pigeons, the dog before the guinea-pig.

The remarkable fluctuation in temperature observed in nearly all these experiments is interesting, but I do not attribute it to the influence of oxygen. I have never noticed a rise of temperature in these experiments except in cold-blooded animals, and this fact alone argues against increased tissue oxidation.

In warm-blooded animals the normal temperature averages considerably higher than in man, and fluctuations of 6° or even 10° F., which are occasioned by trivial causes, may occur without any serious attending phenomena. I have often seen a dog's temperature fall 3° or 4° from simply inhaling ether. The heat-regulating mechanism of the lower animals in far less perfect than our own. They have a greater range of temperature in individual cases. In these experiments the fall of temperature noted is undoubtedly produced merely by the profound disturbance in the circulation and consequent increased heat-loss or diminished heat-production. Moreover, the rapid release of the pressure abstracts heat from the surface of the body. The fall of temperature is equally decided in atmospheres of compressed air and of compressed oxygen. It is greatest when the pressure has been very high, where it has been

suddenly removed, and when convulsions and dyspnœa have been intense. I have often noticed a similar loss of temperature produced by asphyxiating an animal under an air-pump. Therefore this remarkable heat-loss is in nowise associated with an increase in oxygen absorbed.

Experiment 4.—A monkey was kept in the tank for two hours and a quarter, under a pressure which was gradually increased up to 45 pounds of oxygen, and then slowly diminished. The animal during all this time played about, and seemed perfectly normal. When the pressure reached zero it was suddenly raised again in eight minutes to 51 pounds of oxygen, nearly $4\frac{1}{2}$ atmospheres in all. He was kept at nearly this pressure for forty-five minutes more, without appreciable effect of any kind. Just before removal, after spending three hours and a half in the tank, the animal had a slight convulsion. The rectal temperature fell $1\frac{1}{2}°$.

Experiment 5.—Is a repetition of the preceding experiment. A monkey and pigeon were kept for over two hours in the tank under a pressure of oxygen which registered 30 pounds during most of that time. Very slight dyspnœa occurred towards the end, but no other symptoms resulted. The monkey's temperature fell 4·2°, the pigeon's only 1° F.

Experiment 6.—A cat was placed in the tank, and oxygen pressure was rapidly added until, at the end of an hour, it registered 90 pounds—in all 7 atmospheres. No convulsions occurred until 70 pounds of pressure was reached. After one hour and a half in all the animal was removed, and it soon died from pulmonary congestion and dilatation of the right heart. Some emphysema was found in the thinner portions of the lungs. Bert states, as a result of his experiments, that at $3\frac{1}{2}$ atmospheres of oxygen, animals die from asphyxia and convulsions. In this experiment, twice that pressure was borne for some time, although it ultimately proved fatal.

Experiment 7.—Three pigeons were kept for one hour and a half under a pressure of 40 pounds of oxygen, nearly 4 atmospheres in all. One of them alone had convulsions, and on removal it remained for some days with the muscles in a curious condition of rigidity and contracture, and all attempts at moving it threw it into violent convulsions. The bird lay on its back for four days, with neck and legs strongly flexed. The animal had had its cerebellum removed some weeks before, and I think the peculiar symptoms were due to the pressure affecting the surface of the brain unduly through the opening in the skull, rather than to any influence

of the oxygen. The two other pigeons survived and were normal.

Experiment 8.—A dog was kept for an hour at a pressure of 4 atmospheres, composed of three fourths oxygen. There were a few convulsions, but the dog recovered. The rectal temperature fell 5·4° F.

Experiment 9.—A cat and dog were kept alive for an hour under an additional atmosphere of oxygen in a confined space, where the ordinary air would have been fatal to either animal alone in less than half that time.

Experiment 10.—A similar experiment was repeated, using compressed air instead of oxygen, with a like good result. Having determined the effect of high pressures of oxygen, I next tried to learn to what extent the convulsions, which are common above 4 atmospheres, are caused by the pressure alone, or to what extent they might be due to some specific action of oxygen. In all the experiments thus far described, the convulsions were immediately relieved by blowing off 5 or 10 pounds of pressure. It is also noticeable that, while the pressure was being either increased or diminished, the animals evinced a certain amount of restlessness, which was usually greater when the pressure was falling, and which promptly subsided. In the following experiments the animals were subjected to exactly the same conditions upon successive days, with the exception that compressed air was used on one day, and oxygen on the next. The pressure was added or released at the same rate in each case, and the exhaled CO_2 was removed by a solution of KOH.

Experiments 11 *and* 12.—A dog weighing $22\frac{1}{2}$ pounds was subjected to rapidly increasing air pressures. A total pressure of 8 atmospheres was reached (inside of twenty-six minutes) before the animal had a convulsion, or even appeared discomforted. When oxygen was given the next day, at the same rate, convulsions occurred when the total pressure had reached 5 atmospheres, and when $6\frac{1}{3}$ atmospheres were reached the convulsions became so violent as to shake the heavy tank and threaten immediate death. It was with difficulty that he was rescued by releasing the pressure, and whereas on coming out of 8 atmospheres of compressed air the dog appeared normal, on coming out of $6\frac{1}{3}$ atmospheres of oxygen he had tremors, incoordination, salivation, staring eyes, and jerky dyspnœic respiration. There was no *râles* in the chest. Ether was given to control the convulsions, which persisted after his liberation, and he survived.

Experiment 13.—A further test was made the next day by allowing this dog to remain in the closed tank, breathing common air under 15 pounds pressure, until he became decidedly asphyxiated in twenty-seven minutes, with mouth-breathing and respirations 120. Ten pounds of oxygen pressure were added, and the respirations fell to 38, with great relief of the dyspnœa. The oxygen pressure was finally raised to 45 pounds, when convulsions occurred.

Experiments 14 *and* 15.—A cat and dog were together placed in the tank and allowed to remain until, after twenty minutes, both animals were decidedly asphyxiated. When both animals were on the verge of convulsions, the dog's respiration being 120 and the cat's 80, 5 pounds of oxygen pressure was added, with instant relief; the dog's respiration fell to 40 and the cat's to 60. When the dyspnœa again returned after an interval, it was always relieved by adding a little oxygen until 30 pounds pressure had been reached. After fifty minutes the animals were released in good condition. The exhaled air, collected at intervals, contained a very large percentage of CO_2, yet a candle burned brightly in it. The next day the same animals were replaced in the tank, and 22 pounds of oxygen pressure were added at once, which they bore for forty-five minutes, with but slight dyspnœa toward the end.

Experiments 17 *and* 18.—A large cat was placed under a pressure of 55 pounds of oxygen, or $4\frac{2}{3}$ atmospheres in all, and in two minutes severe convulsions resulted. The next day the same animal was kept for thirty-five minutes under the same pressure of atmospheric air without any ill effects at all.

The day following, the animal was left in the tank for twenty minutes, when it showed intense dyspnœa (the cat's body filled $\frac{1}{10}$ of the capacity of the tank); 10 pounds of oxygen pressure was then added with immediate relief which lasted for one hour. At the end of this time the oxygen pressure was increased to 30 pounds, and the cat remained comfortable for three hours and three quarters in all. On removal a convulsion occurred, but the animal was restored by chloroform. KOH was used to absorb the CO_2. The rectal temperature fell $5\frac{1}{5}^\circ$ F. during the experiment.

All of the experiments thus far reported were made with perfectly healthy animals. They prove that:

1. When the breathing is normal, oxygen and atmospheric air do not differ materially in effect up to about 2 atmospheres of pressure.

2. Both oxygen and air under pressures between ½ and 2 atmospheres relieve the dyspnœa produced by inhaling vitiated air, and oxygen has a distinctly greater effect in this regard than air.

3. The effect seems to be exerted through the respiratory centre, diminishing the rate of breathing, and improving the rhythm of the respiration.

4. Above 2 or 3 atmospheres a much greater pressure of air than of oxygen can be borne without inducing convulsions.

The cause of the convulsions is still undecided.

The cause of the ordinary normal respiratory impulses is believed, by the great majority of experimenters at the present time, to be the lack of oxygen in the blood conveyed to the respiratory centre in the medulla. Others, however, believe that the presence of excess of CO_2 in the blood is an equally potent factor; and there are a few physiologists who claim that the lack of oxygen excites inspiration, and that the presence of excessive CO_2 may excite forced expiration.

Convulsions are produced by suddenly withholding oxygen, and convulsions of a somewhat different type may be produced by inhaling a large percentage of CO_2. It is possible that they may be also produced by nitrogenous waste matters (probably volatile ptomaïnes?), which are either re-inhaled, or which cannot be exhaled. Whichever theory we adopt, the fact remains that the convulsions are precipitated when the pressure of the inhaled atmosphere reaches a certain maximum. I submit the following theory regarding these convulsions:—That they are due to the physical law that "the diffusion-constant of two gases is inversely as the pressure," and, therefore, the higher the pressure the less the rate of diffusion. In normal breathing the air in the upper part of the lungs only is exchanged mechanically as we know. The air of the more deeply-seated air-vesicles, which contain an excess of CO_2, is changed by diffusion at a definite rate for ordinary atmospheric pressure. If the pressure of the inhaled atmosphere, be it oxygen or common air, is greatly increased, it is more difficult, and it requires more time, for the CO_2 to diffuse from the blood into the air-vesicles, and from the air-vesicles into the tidal air in the wider portions of the air-passages. As a result the CO_2 tends to accumulate in the blood, and, further, by its retarded diffusion from the residual air in the vesicles, it tends to keep back the oxygen of the tidal air from closer approach to the capillaries. Hence the blood is prevented

from taking up sufficient oxygen, and at the same time its CO_2 and volatile nitrogenous waste matter accumulate, and convulsions result. The fact that increased oxygen pressure causes convulsions sooner than increased air pressure may possibly be due to the greater difficulty that CO_2 experiences in diffusing into pure oxygen highly compressed, as compared with common air; but this is at present purely hypothetical. Another very important consideration is the fact that with greatly increased pressure the solubility of CO_2 in the blood is much increased, and it therefore tends to diffuse out less readily into the air-cells.

Pure oxygen under *slightly* increased pressure is beneficial because it mixes readily enough with the CO_2 present in the lungs, and *a very little* more of it may be absorbed by the plasma. But under greatly increased pressure diffusion becomes too slow and difficult, and convulsions ensue.

The next problem is the discussion of the influence, upon abnormal respiration, of oxygen inhaled under increased pressure. For the present purpose, without going deeply into the manifold exciting causes of dyspnœa, we may classify its principal varieties as follows:

I. Dyspnœa due to abnormal conditions of the air, especially to diminished oxygen supply from obstruction to the entrance of air, to increased CO_2 or nitrogenous waste, or to other poisonous gases.

II. Dyspnœa due to abnormal conditions of the blood, either diminished number of red discs, or diminished oxygen-carrying power of the red discs, *i. e.* diminished hæmoglobin.

III. Dyspnœa due to obstructed circulation, arising from a feeble heart, pulmonary congestion, &c., which retard the blood-current.

IV. Dyspnœa due to diminished surface of aëration for the blood, from compression of the lung by fluid, from consolidation, or other causes, as feeble expansion of the chest.

V. Dyspnœa of purely neurotic character, with normal lungs.

Regarding the latter, it may be said that there seems to be a general "respiratory sense," corresponding to the general sense of hunger, thirst, &c. We mentally refer dyspnœa to the chest, as we mentally refer thirst to the throat; yet in cases of gastric fistula, thirst is relieved by injecting water into the stomach. Thirst may also be relieved by immersing the body in water.

It is a matter of common observation to see certain cases of pneumonia or of phthisis in which the patient, while

perfectly conscious, feels no distress in breathing, yet the rhythm and rate of respiration are wholly abnormal. On the other hand, there may be decided subjective dyspnœa without discoverable lesion in the respiratory system such as occurs in hysteria, and as a premonition of uræmia, &c.

I am at present engaged upon a series of new experiments by which some of these varieties of dyspnœa are artificially induced, and then the effect of inhalation under pressure of oxygen is studied.

A few of these experiments I will report:

Experiments 19 *and* 20.—In a cat with both vagi cut there was no appreciable dyspnœa so long as the animal remained quiet and had plenty of air. The cat was shut in the tank breathing confined air, uncompressed, until intense dyspnœa resulted of the well-known cut-vagus type. Inspiration became very deep and prolonged, the nares and mouth were wide open, every accessory respiratory muscle was called into action, and an exaggerated pause occurred between the end of inspiration and beginning of expiration, the latter being sudden and forcible. In addition there were tremors of the head and legs; 7 pounds of oxygen pressure were then added, with instant relief of all the symptoms. The cat was removed after fifteen minutes, and allowed to rest until the next day, when it was still alive with quiet respiration. The animal was then urged to walk a few steps until intense dyspnœa occurred as before. On being placed in the tank in this condition, compressed air was added under the same pressure as the oxygen used on the previous day. Instead of producing relief the dyspnœa was augmented, and when the pressure was increased to 3 atmospheres the dyspnœa became most intense. There were loud tracheal *râles* audible through the wall of the tank, which transmits respiratory sounds with remarkable clearness. Restlessness and weakness became extreme. On releasing the animal it was restored to its previous condition of comfort. In these experiments the pressure effects were very decided.

Experiment 21.—It took forty minutes for the same animal to acquire marked dyspnœa, with both vagi cut, in confined air at 1 atmosphere, whereas 2 atmospheres of air produced immediate severe dyspnœa. The interesting feature of these experiments is that the dyspnœa which occurred in an exaggerated form after section of both vagi, and poisoning by confined air, was relieved by adding 7 pounds pressure of oxygen to the already foul air.

Experiment 22.—A young but large dog, with a cannula

half an inch in diameter inserted in right pleural cavity. When the cannula was closed with a cork respiration was normal; when it was open there was great dyspnœa, and respiration was increased to 66 and shallow. The dog was placed in the tank with the cannula open, and 15 pounds pressure of oxygen were added. In twenty minutes respiration fell from 66 to 32, and became very deep and laboured. The oxygen was blown off and the respiration rose to 47. Then 40 pounds pressure of common air were added. The animal again became very uneasy and the respiration slower and deeper. In fifteen minutes more he was liberated, and the cork was replaced.

This experiment demonstrates that, when an animal is deprived of half the normal breathing-space by collapse of one lung produced by a free opening in the pleura, both compressed oxygen and compressed air reduce the frequency of respiration, but add greatly to the distress of the animal from the mechanical effects of the pressure. If there was any specific difference between the oxygen and common air in this case, it was obscured by the evil mechanical effects of the increased pressure.

Experiment 23.—In another experiment I produced extreme dyspnœa from local pulmonary congestion from injection of silver nitrate solution into the lung tissue. The animal (a cat) was placed in the tank when the respiration was 150 and very shallow; there was great prostration, the animal being scarcely able to stand. Ten pounds of oxygen pressure were added, and in three minutes respiration was slowed to 80 and became much fuller, and the animal seemed greatly relieved and stronger. On increasing the oxygen pressure to 20 pounds the respiration fell to 64, the cat stood up, licked her paws, and moved about in a natural manner. After an hour under this pressure the cat was liberated, and she became immediately worse. The respiration increased, and the cat again became so feeble as to constantly lie down. In this case of acute pulmonary congestion the inhalation of oxygen under pressure gave remarkable relief to the dyspnœa and general distress. Autopsy showed only one lobe to be congested on the side of the injection.

Experiment 24.—Dog, weight $16\frac{4}{5}$ pounds. I injected 550 c.cm. of water into a dog's right pleural cavity to compress the right lung and diminish the space for aëration of the blood. Respiration became very deep and laboured, and while at rest the rate was 35. While exercising, respiration became 100 and shallower. The animal was placed

in the tank, and 10 pounds were added of a mixture of 4 parts oxygen + 1 part nitrous oxide. In three minutes respiration fell from 60 to 48, and the dog seemed much relieved and very drowsy. After fifteen minutes the pressure was gradually increased to 45 pounds, when a violent convulsion occurred in four minutes. This was controlled by releasing the pressure slowly. After remaining one hour in the tank the animal was removed. The temperature had fallen $4\frac{1}{4}^{\circ}$ F.

In this experiment, where the area for aërating the blood was diminished by one half, the respiration became much more natural on inhaling a mixture of 4 parts oxygen + 1 part nitrous oxide under pressure. No different effect was noticed in using this mixture from that obtained by pure oxygen.

Experiment 25.—A puppy weighing $14\frac{1}{2}$ pounds was bled to the extent of $2\frac{1}{2}$ ounces. Respiration became very irregular and the animal appeared very weak. He was given the same mixture of $4(O) + 1(N_2O)$ under various pressures. At pressures under 10 pounds he was much relieved, but under 3 atmospheres the dyspnœa was greatly increased, and he became too feeble to stand.

Experiments 26 *and* 27.—A dog weighing $16\frac{3}{4}$ pounds was bled to the extent of 10 ounces. The resulting dyspnœa was relieved by adding 4 pounds of pressure of the mixture used in the previous experiments. Subsequently the dyspnœa returned, and being again placed in the tank under 10 pounds of oxygen pressure added to the air already present, his condition improved in a marked degree. But when 30 pounds of oxygen pressure were added, the dyspnœa became intense. It was again relieved by reducing the pressure.

These experiments have not been performed with high pressures because we can make any clinical use of such pressures, but in order to find the limits of the maximum effect of oxygen, as an aid to inferring the clinical results which are possible under 1 atmosphere of pure oxygen, *i. e.* in which the oxygen tension is increased to 15 pounds. The experiments, although as yet incomplete, certainly demonstrate that oxygen under moderately increased tension does aid certain types of dyspnœa.

We now come to the second division of my subject, the Therapeutic Value of Oxygen Inhalation.

It is not very feasible to give oxygen to man under pressures above that of the atmosphere. My own experience in

this regard is confined to the use of compressed air in a few severe cases of spasmodic asthma, which were greatly improved, I think rather by the general air-pressure than by the slight increase in oxygen tension produced by an additional atmosphere.

Dr. Valenzuela, in a paper read before the Royal Academy of Medicine of Madrid two years ago, reports the use of oxygen inhaled under seven times the ordinary oxygen tension of the air (*i.e.* $1\frac{1}{2}$ atmosphere of pure oxygen). Several cases of pneumonia in man were greatly benefited. At the end of an hour in one case the temperature fell 1·7° C. He also speaks of reducing the temperature of rabbits having septicæmia, by inhalation of oxygen under increased tension. For reasons given earlier in this paper, I believe that the reduction of temperature was due to pressure effects, and that it would have occurred equally had compressed air been used instead of oxygen.

The inhalation of oxygen is no new remedy. Its therapeutic use was suggested by its discoverer, Priestley, in 1774. But it has suffered much from the extolment of quacks, who take advantage of the popular knowledge that without oxygen there is no life, and the belief that, consequently, the more oxygen is given the more vigour results, and that ozone is a public boon even beyond oxygen in power. Whereas it is a physiological impossibility to take ozone into the blood through the lungs, and even were it possible, its presence there is incompatible with the continuance of the circulation (Oertel).

The legitimate clinical use of oxygen is, however, constantly advancing, not after the manner of so many new remedies that spread throughout the country, offering fame to all who first report their trial to-day, and which pass into oblivion to-morrow; but the advance is steady and convincing.

Until recently, oxygen could only be obtained from illuminating companies, and those who have given it trial in impure forms, and without system, have generally misjudged it. To-day it is prepared by many manufacturers, exclusively for medical use, with guarantee of its purity, and many of our hospitals have oxygen generators of their own.

Oxygen is employed therapeutically (1) as a curative measure in diseases of the blood, circulation, and respiration; and (2) as a palliative measure in extreme subjective and objective dyspnœa.

The therapeutic use of oxygen is now very prevalent in the United States and in Continental Europe. Two or

three hundred thousand gallons are inhaled yearly in this city alone. During the cholera epidemics of Toulon and Marseilles, in 1886, it proved a most useful adjunct to other treatment. It is employed with success in many cases of opium narcosis, coal-gas asphyxia, chloroform poisoning, &c.

In performing my experiments I have received valuable aid from Dr. John C. Cardwell, assistant to the Physiological Laboratory at the New York University Medical College, as well as from several students of the College.

The portion which we have omitted of this valuable paper deals with the use of oxygen in several diseases of man, and as such it is not quite fitted for our pages.

THE VENA AZYGOS IN CLOVEN-FOOTED ANIMALS.

By R. W. Burke, A.V.D., Athlone.

The relation of the large vena azygos with the other vessels differs in ruminants and swine from that found in the horse. In the latter it most frequently enters the anterior vena cava and sometimes the right auricle directly, close to it. In the former it enters the right auricle below the posterior vena cava, occupying the place of the coronary vein. It varies in its position also with reference to its relations with the right and left auricles in the different species. In the horse it is seen to enter directly in relation with the right auricle, whereas, in the case of the artiodactyla, in descending from the spine, it curves round in relation first with the left auricle, and receives the mouth of the coronary vein before it opens into the right auricle below the posterior vena cava. In the horse the vena azygos runs along the right side, and in ruminants along the left side of the spine.

The great coronary vein in the horse opens directly into the right auricle; in the artiodactyla it (or rather the smaller cardiac veins) joins the large vena azygos before that vessel enters the right auricle.

The large vena azygos in larger ruminants, as the cow and buffalo, is partly overlapped in its course by the posterior aorta; in the smaller ruminants, as the goat, sheep, and deer, it is visible throughout its whole course along the left side of the spine.

In the horse the large vena azygos runs along with the thoracic duct on the right side of the posterior aorta and spine. In cloven-footed animals it passes forward along the

left side, running parallel with the posterior aorta and receiving the intercostal veins, till it reaches the spine opposite the base of the heart, where it descends, forming an angle in relation with the left auricle, before it receives the mouth of the coronary vein and enters the right auricle.

The small vena azygos gives off one or more smaller anastomosing branches which open into the large vena azygos before it reaches the base of the heart. In the horse the large vena azygos being situated always on the right side, there are no such anastomosing branches above described. Hence some anatomists have described the large vena azygos to be a prolongation of the smaller one.

After placing the animal on its back and opening the chest, in the case of cloven-footed animals, turn the left lung towards the mediastinum and expose the vena azygos, which will be seen running along the left side of the spine. On turning over the right lung to the mediastinum no such vessel will be seen. In the horse, however, as is well known, the large vena azygos invariably takes the opposite side. In cloven-footed animals the venæ azygos, large and small, both occupy the left side of the spine, and frequently also anastomose by means of one or more smaller vessels. Hence it is, anatomists have most probably mistaken the large or great vena azygos to be a prolongation of the smaller one. In the horse, as we are already aware, the large vena azygos is found on the right side, and the small on the left. There is no vena azygos on the right side in ruminants.

It would appear that anatomists, having seen the large vena azygos in ruminants on the left side of the spine, have taken it to be a prolongation of the small vena azygos, as is sometimes the case in horses. However this may be, we would submit the above notes for consideration.

THE SURGICAL USES OF ANTISEPTICS.

Dr. G. Sims Woodhead, Superintendent of the Research Laboratory of the Royal College of Physicians, Edinburgh, has contributed to the June number of *The Journal of Comparative Pathology and Therapeutics* a valuable article on antiseptics and their use in veterinary surgery, from which we make the following extracts:—Bacteria, he urges *in primis* must now be regarded as the *fons et origo mali* of traumatic infective fevers, septicæmia, and pyæmia. They are minute micro-organisms or vegetable germs, which float

in the atmosphere, and are liable to fasten upon wounds. They find on damaged and diseased surfaces fitting habitat and pabulum, multiply rapidly, and extend their destructive operations among adjacent healthy tissues. From the disintegration of the textures they, moreover, form various ferments, xymines, or ptomaines, which exert poisonous effects on nerve centres, disturb various functions, and sometimes destroy life. The relative influence on animal health of the bacteria, and of these soluble ferments to which they give rise, has not yet been fully determined.

The multiplication of bacteria, the diffusion of them and of their septic products, and the train of evil effects which follow, are frequently exhibited in the case of badly treated wounds, especially in unhealthy subjects. The animal becomes very feverish and prostrated, while a low type of inflammation is apt to invade various structures often remote from the original wound. Strangles in horses sometimes presents another illustrative form of this distribution of bacteria and poisoning by their morbid products, which in this instance are purulent. The ordinary maxillary abscess forms imperfectly, the patient becomes unusually feverish, and fresh abscesses appear in connection with the lymphatic glands of the shoulder, groin, or internal organs.

To prevent these and other such untoward effects Sir Joseph Lister and his followers wisely enjoin that wounds of all kinds must be maintained in an aseptic state, or, in other words, that no bacteria be allowed to reach them. If these organisms can be kept out of them, wounds heal readily, no destructive breaking down of adjacent tissues occurs, nor does secondary septic or pyæmic poisoning result. So widespread, however, are these hurtful micro-organisms in the air, mostly adhering to dust particles lodged on the skins of the patients themselves, on the hands of surgeons and attendants, and even on the surgical dressings, that they are readily introduced into wounds, especially when these are left exposed in localities crowded with men or animals, or where sanitary arrangements are imperfect. In order to kill the invading bacteria carbolic spray is used in most important surgical operations of human surgery, while wounds accidentally inflicted are irrigated with some effectual antiseptic, and other precautions taken to prevent the introduction of the germs.

Dr. Woodhead very rightly says that an aseptic condition can only be secured and maintained by systematic care and attention to many details. Dust, on which bacteria fasten and are carried, must be reduced to a minimum by the

thorough cleansing of places where surgical operations are performed, or where animals with accidental wounds are treated, while the premises are subsequently sprinkled with such germicides as corrosive sublimate or carbolic acid. The skins of animals on which operations are to be performed are directed to be shaved along and around the line in which the incision is to be made, and washed with soap and water, with a mixture of spirit and ether, in order to remove the secretions of the sweat-glands, amidst which micro-organisms may lodge, and finally rinsed with a 5 per cent. carbolic, or a ·1-1000 solution of corrosive sublimate. The hands of the surgeon should be thoroughly washed with soap and water, the nails scrubbed with a brush, the mixture of alcohol and ether well rubbed in, and a final laving given with the antiseptic solution. Instruments, ligatures, dressings, and bandages require similar antiseptic treatment.

Dr. Woodhead explains the relative merits of the several antiseptics commonly used in human and veterinary surgery. Mercuric chloride, popularly known as corrosive sublimate, has long been recognised as a most valuable germicide. Koch maintained that 1 part dissolved in 1000 or even with 5000 of water suffices to destroy the most resistent organism in a few minutes. It has been shown, however, that the efficacy of corrosive sublimate is somewhat reduced by its ready combination with the albumen present in the blood and animal tissues ; but this disadvantage is mainly obviated by using it with common salt, and the proportions recommended by Lister and Woodhead are—corrosive sublimate 1 part, common salt 7½ parts, water 1000 parts.

Dr. Woodhead prefers mercuric iodide to corrosive sublimate, and indeed to most antiseptics, for the following grounds:—(1) It does not, like the chloride, dissolve albumen, and hence its antiseptic effects are not diminished by the presence of blood or albuminous textures. (2) It does not unite with albumen, nor does it decompose the delicate tissues, and produce the film of slough caused by corrosive sublimate and most other active antiseptics. (3) It is not so poisonous as the chloride, and risk of poisoning by absorption is hence much less. (4) Its properties are not interfered with by acids or alkalies, nor by the salts present in ordinary drinking-water, which may accordingly be used as a solvent for it. One part each of mercuric iodide and potassium iodide, which is added to ensure solubility, are dissolved in 1000 parts of water.

Zinc chloride has long been prized as an effectual antiseptic, and is used in the proportion of 1 part to 15 or 20 of

water. But it combines readily with albumen, thus acts as a caustic, checks granulations, and hence should not be used, unless in a very diluted solution, where wounds are expected to heal by first intention.

Carbolic acid, according to the circumstances in which it is applied, is dissolved in from 30 to 40 parts of water. Being volatile, it permeates even deep and extensive wounds. Dressings with which it is incorporated continue to give it off gradually, thus maintaining wounds and discharges in an aseptic state for several days. But when of such strength as to be thus effectual it is a somewhat powerful caustic, and although often very serviceable for the earlier dressings, a less powerful agent should be substituted when granulation is to be encouraged.

The milder antiseptics which do not injure the delicate tissues are sulphurous acid, chlorinated soda, and boric acid, which are used in the form of solution or ointment.

Hydronaphthol is a recently discovered antiseptic—a secondary compound of betanaphthol—which has been found by Dr. Edington, when dissolved in lukewarm distilled water, to be about half the germicide strength of corrosive sublimate. It is non-poisonous, and does not combine with albumen or cause appreciable sloughing of the tissues with which it comes into contact. One part is used in 300 of water, solution being ensured by adding a little spirit.—*North British Agriculturist.*

INFLUENCE OF THE SPLEEN ON THE BACILLI IN THE BLOOD.

"Dr. von Karlow, wishing to find out whether the spleen has the destructive influence upon bacilli introduced into the circulation that has been assigned to it by many, performed a number of experiments with the object of setting this question at rest. For each experiment he took two rabbits as nearly alike in size and weight as possible, and extirpated the spleen in one of them. Two or three months afterwards he injected an equal quantity of some particular bacillus culture into the auricular vein of each, and examined the blood after the lapse of half an hour and an hour and a half, killing the animals after two hours. No perceptible difference could be detected in the distribution of the bacilli in the two animals. Similar results were obtained when attenuated cultures were employed. The bacilli

experimented with included those of anthrax, chicken cholera, diphtheria, and porcine erysipelas, staphylococcus pyogenes aureus, and the cocci of erysipelas. It may be mentioned that in one case, where Emmerich's bacilli were used, the animal without the spleen lived, while the one that had not been operated upon died."—*Lancet.*

ALLEGED POISONOUS EFFECTS OF TOBACCO SMOKE ON MEAT.

"CASES of poisoning due to meat which seems thoroughly wholesome have sometimes occurred and have remained unexplained. In the *Revue d'Hygiène* of this month M. Bourrier, inspector of meat for the town of Paris, makes a valuable suggestion. He describes his experiments with meat impregnated with tobacco smoke. Some thin slices of beef were exposed for a considerable time to the fumes of tobacco, and afterwards offered to a dog which had been deprived of food for twelve hours. The dog, after smelling the meat, refused to eat it. Some of the meat was then cut into small pieces and concealed within bread. This the dog ate with avidity, but in twenty minutes commenced to display the most distressing symptoms, and soon died in great agony. All sorts of meat, both raw and cooked, some grilled, roasted, and boiled, were exposed to tobacco smoke and then given to animals, and in all cases produced symptoms of acute poisoning. Even the process of boiling could not extract from the meat the nicotine poison. Grease and similar substances have facilities of absorption in proportion with their fineness and fluidity. Thus the fats most readily influenced by tobacco smoke are, in their respective order, the fat of horseflesh, of pork, of veal, of beef, and finally of mutton. Hashed meat is, of course, more readily affected than large pieces; thus, a few puffs of smoke directly projected on to sausage meat will give it a characteristic and unpleasant taste. The juices of meat are equally dangerous. The juice squeezed out of some veal perfectly saturated with tobacco smoke was injected into a rabbit, and death resulted in a few moments. Fresh-killed meat is more readily impregnated, and stands in order of susceptibility as follows—pork, veal, rabbit, poultry, beef, mutton, horse. The effect also varies considerably according to the quality of the tobacco, and the end of a cigar or a pipe has the most injurious effect on any meat that may be exposed close to the smoker. A few jets of smoke from Belgium tobacco on

a dish of raspberries will suffice to entirely destroy the delicate flavour of the fruit and to render it uneatable. All these experiments would seem to denote that great care should be taken not to allow smoking where foods, especially moist foods, such as meats, fats, and certain fruits, are exposed." —*Lancet.*

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

MONTHLY COUNCIL, December 11th, 1889.
LORD MORETON, President, in the chair.

VETERINARY COMMITTEE.

Sir John Thorold (Chairman) stated that Professor Brown had presented the following report, as well as the annual report of the Royal Veterinary College, which the Committee proposed should be published in the next number of the *Journal.*

Pleuro-pneumonia.—During the five weeks ended November 30th there were thirty-one fresh outbreaks of this disease in Great Britain—nineteen in England, in the counties of Cumberland, Essex, Herts, Kent, Lancaster, and Norfolk; the twelve outbreaks in Scotland occurred in the counties of Ayr, Edinburgh, Forfar, Perth, Renfrew, Peebles, and Selkirk. The two last-named counties have recently got the disease introduced by cattle bought in public sale-yards.

The number of cattle attacked in Great Britain was 123, and 448 cattle exposed to infection were also slaughtered. In Ireland seven outbreaks were reported, all in the Dublin district. Twelve cattle were attacked, and 146 healthy ones in contact were slaughtered.

Anthrax.—In England twenty outbreaks of this disease were reported, thirty-four animals were attacked, six of which were killed, and twenty-eight died. In Scotland there were five outbreaks of anthrax; six animals were attacked, all of which died. In Ireland three outbreaks occurred, in which four animals were attacked and died.

Swine Fever.—During the five weeks there have been 355 fresh outbreaks of this disease in Great Britain, and 2365 pigs attacked. This shows a marked decrease as compared with the returns for the corresponding period of last year, when there were 478 outbreaks and 3109 swine attacked.

A return as to the prevalence of pleuro-pneumonia since the Slaughter Order came into operation on March 10th, 1888, had been received from the Board of Agriculture. A letter had been received from Professor Brown, asking for the assistance of the Society in the endowment at the Royal Veterinary College of a Chair for original investigation and research in Comparative

Pathology and Bacteriology. After careful consideration of this proposal the Committee were unanimous in recommending that, instead of the £200 annually voted to the Royal Veterinary College, an annual grant of £500 be made to the College for the purpose of establishing a Chair of Comparative Pathology and Bacteriology, subject (1) to six months' notice on the part of the Society for the discontinuance of the grant; (2) to the College undertaking, as before, to investigate any outbreaks of disease amongst animals that may be reported by members, and to defray the expenses of such investigations when considered necessary or advisable; and (3) to the existing veterinary privileges of members being continued as at present.

The Promotion of Skilled Farriery.

A letter was read from the Farriers' Company, requesting the Society's co-operation in holding a conference between representatives of the Company, of the Royal College of Veterinary Surgeons, and of the Royal Agricultural Society, for the purpose of considering the best means of promoting farriery and the registration of duly skilled qualified farriers. It was decided to adopt the recommendation of the Veterinary Committee, and to convene the conference for Thursday, December 12th, at 3 p.m.

Memo.

This conference was held on Thursday afternoon, December 12th, at 12, Hanover Square, and was attended by the following delegates:

The Worshipful Company of Farriers.—Mr. Sydney Smith (Acting Master), Mr. George Burt (Past Master), Mr. Barnes Wimbush, M.A., and Mr. F. Bayard, LL.M. (Wardens), Mr. Nathaniel L. Cohen, and Mr. Wynne E. Baxter (Clerk).

The Royal College of Veterinary Surgeons.—Professor Axe (President), Professor Brown, C.B., Sir Henry Simpson, Mr. William Hunting, F.R.C.V.S.

The Royal Agricultural Society of England.—Lord Moreton (President) in the chair, Sir John H. Thorold, Bart. (Chairman of the Veterinary Committee), Mr. Charles Clay (Steward of Horseshoeing, 1887 to 1889), Mr. Hugh Gorringe, Mr. Albert Pell, Mr. Christopher W. Wilson.

A draught scheme for the examination and registration of farriers, which had been prepared by the Court of the Farriers' Company, was discussed at length, and referred to a sub-committee of nine members—three from each of the institutions represented—with instructions to consider the scheme and report to their respective bodies.

CENTRAL VETERINARY MEDICAL SOCIETY.

An ordinary general meeting of the above Society was held on Thursday, December 5th, at the First Avenue Hotel, Holborn. Mr. William Hunting, the President of the Society, occupied the chair, and there were present Messrs. Bishop, Broad, Buston, A. P. Case, Caton, Elworthy, Farrow, Gostling, Hibbard, Hurndall, Irving, Clement Lowe, T. Moore, Mulvey, Reddish, Rickards, Rogers, Rogerson, Roots, Rowe, Slocock, F. W. Stanley, Wragg, and the Hon. Secretary.

Letters and telegrams were read from Professor Walley, Messrs. Roalfe Cox, Darling, of Weybridge, Hy. Edgar, J. F. Simpson, and Fitzwilliam Wright, apologising for non-attendance.

Mr. Henry Gray, of West Ham, was nominated for Fellowship of the Society.

The *Secretary* announced the receipt of a pamphlet from Mr. Frank S. Billings, of Nebraska, U.S.A.

Mr. Elworthy brought under the notice of the meeting two pedal bones, one of which showed extensive disease, the result of the horse's foot being run over by a truck, and the other was complelely divided from before backwards, the fracture being the result of the horse "picking up" a French nail.

Mr. Arthur Rogerson then read his paper on "Injuries to the Foot," as follows:

Mr. President and Gentlemen,—To every veterinary surgeon the injuries and diseases occurring to the foot of the horse are important and interesting; but to those who combine a forge with their practice, they possess more than a scientific importance, a forge being undoubtedly a great source of worry and anxiety to the practitioner, and at times attended with troubles and litigation.

It must be acknowledged that most of the injuries to the foot are attributable either directly or indirectly to the forge, and therefore *may* be due to negligence.

It should be our endeavour to avoid these cases, and a correct understanding of their origin and cause is a long step on the way to their prevention.

I propose, then, first to consider those injuries occurring in the forge, and to begin with what is commonly termed a—

Burnt Sole.—This condition is brought about by applying the shoe too hot whilst fitting it to the foot, and the part of the foot most liable to this particular kind of injury I have found to be around the sole at the toe. This may no doubt be attributed to the extra amount of pressure brought to bear on the shoe at the time of fitting, and to the greater amount of susceptibility—this part of the foot being usually thinner than any of the rest, and when this condition is noticeable, it is a good plan to apply a little stopping over the thin place before fitting.

Another cause which I think worthy of mention in passing is that it is by no means uncommon for the smith, whilst in the act of fitting, to rest the toe of the shoe on the end of the rasp, thus causing an additional amount of pressure at this part of the foot.

The lameness resulting from this kind of injury quickly follows, and it is not unfrequently of a very acute kind ; the next morning probably the horse will scarcely be able to bear his foot in contact with the ground.

On removal of the shoe, and with a little careful manipulation, the seat of the injury will soon be detected. On cutting away the superficial layers of the sole the appearance presented is of an unmistakable and pronounced character ; the burnt horn fibres are usually accompanied with an exudation of a sero-sanguineous nature, and most acute pain is evinced on the slightest pressure to the part.

If the injury is not of so serious an extent as to involve the more deep-seated structures of the foot, the case will, as a rule, be quickly amenable to the ordinary treatment, and with a few days' rest and the application of a leather sole and a side-clipped shoe, the horse will generally be sound and fit for work again.

I have a distinct recollection of one fatal case accruing from a burnt sole.

The next, and I think it may be said the most frequent kind of injury which we have to encounter is that ordinarily denominated—

Pricking.—Pricks or punctures to the horse's foot during the time of his being shod are the results of nails being driven, either carelessly or otherwise, so far as to damage the sensitive structures within the horny appendage.

Pricking may be classified into two kinds. *Firstly*, where the nail is actually driven so far as not only to penetrate the sensitive soft structures, but even in occasional instances the bone itself. When the latter is the case, I have no hesitation in saying that it is entirely due to gross ignorance or want of skill on the part of the shoeing-smith ; and the result is a mutilation which is in nine cases out of ten attended with fatal consequences. *Secondly*, that which may or may not be ascribed to any fault of the smith ; for instance, where the nail is driven so close as to cause bulging of the inner layer of the horn (frequently the result of what is termed "buckling of the nail"), and consequently pressure is brought to bear upon the sensitive interior, leading on to inflammation with or without suppuration and lameness. To this description, according to the farriers' phraseology, the term "nail-bound" is generally applied.

The various causes which may enhance the possibility of pricking are badly fitted shoes, coarseness of the nail-holes in the shoe —causing the nail to pitch and take too deep a hold of the foot, badly pointed nails—as a result we may get splitting of the point and consequent misdirection of the nail in its course. Another and by no means infrequent cause is in not removing the old "stubbs" from the foot previously to driving the nails.

Whilst on the subject of "nails"—since the machine-made and ready-pointed nail has been so largely substituted for the old-fashioned hand-made one—I think it is a question worthy of our consideration, which of the many kinds of machine manufacture is the best to use? So far as my experience goes I give preference to the "Star Nail," not only as regards its make and shape, but also its practical utility.

Injuries of this nature may arise also from a deficiency of horn in any part of the foot, either traumatic or natural. When this is the case it is better for the smith not to attempt the insertion of a nail rather than run the risk of laming the horse. As to natural conformation, I have found that those generally termed "mule-footed" are more susceptible to this kind of injury than any other.

It is not necessarily the case that when the seat of the injury is determined upon, the damage done is to be attributed to the nail in the immediate vicinity. This point must be decided upon at the time of examination, which I need hardly remind you should be done carefully and with some amount of skill. In my opinion, where practicable, the presence of the veterinary surgeon should always be enforced, or he may frequently be misguided and almost perplexed in arriving at a correct decision, by the smith, in order to screen himself, wilfully mutilating the foot in such a way as to render it a matter of impossibility for either the veterinary surgeon or any one else to arrive at any definite opinion as to the actual cause of lameness. The lameness arising from a prick in shoeing generally manifests itself shortly after the horse has been shod, say from two to four days, but it is by no means uncommon for the horse not to drop lame for even two or three weeks afterwards. In the latter case, I may say that during my experience it is, as a rule, not due to the nail in the foot at the time, but to what is usually termed a "drawn nail," and the period that has elapsed between the time of shoeing and the manifestation of the lameness may be explained by the inflammatory action resulting in consequence of the damage done being more tardy in its progress than if it were subject to the continued irritation of a nail left in the foot. I have not found it to be the case, as described by some veterinarians, that when the puncture or prick is at the toe of the foot the suppurative action is much quicker, and makes its way to the coronet more readily than when any other part of the foot is affected. We have nothing to guide us in saying that there is any dissimilarity in the texture of the horn in any particular part, therefore I fail to comprehend upon what ground this theory can be based. Bearing in mind the internal relations of the foot, and the intimate connection subsisting between the sensitive and non-sensitive structures, it may be a matter for surprise and even congratulation that injuries of this nature are not of more frequent occurrence. As pricks in shoeing do and will at times happen to the most expert hands, we ought not to attribute every case to ignorance or blundering. The success to be achieved in the treat-

ment of these cases depends entirely upon the timely relief of the encased matter; and when this is given promptly and skilfully, I may say that, generally speaking, no other kind of foot injury is more easily dealt with; but on reversion of this order I think I am equally right in saying that no other kind of injury to the foot is attended with more disastrous results; hence the unquestionable advisability of the presence of the veterinarian, whose decision of the case should always be final, impartial, and unprejudiced.

Having completed a summary of the injuries which are directly connected with the forge, we now pass on to those which owe their origin to other sources, coupled of course with the mode of shoeing to a greater or less degree, and the first I will mention is—

Corns.—The name of corn is unquestionably a term borrowed from human surgery, probably because, like corns affecting the foot of the superior animal, they are found to originate from a bruise or from continued pressure; but if the comparison be carried further than this, misconception will undoubtedly result, for corns affecting the foot of the horse *must* pathologically be regarded as quite a different disease from that appertaining to the foot of man. The structures involved in the two morbid processes are not of course histologically to be compared.

Corns affecting the animal with which we have to deal are undoubtedly a *great cause* of lameness, particularly amongst the heavier class of horses which are submitted to the constant jar of our London stones. To describe the cause of this malady it would in a great measure be correct to attribute it to faulty shoeing, for as I am not aware of any horse ever being the subject of this affection, previously to his being submitted to the hands of the shoeing smith, and as lameness does not follow for several days after being shod, I think it is feasible to assert the primary offending cause to be the shoe.

The seat of corn is well known to all of you. I should describe it as being situated in the triangular space between the bars and quarters at the heel of the foot. A corn may consist only of a mere contusion or bruise to the villous tissue of the sensitive sole, producing blood extravasation, which permeates the pores of the horn and causes the discoloration so noticeable on removing the superficial layers of the sole. This condition only constitutes the *primary* stage of the foot disease; and if this is accompanied with lameness, and immediate attention is called, the treatment usually adopted is simple and in a general way very effective. But when this is neglected and the primary stage prolonged by allowing the offending cause to remain, the inflammatory action goes on, and the pathological changes that take place result in a collection of *purulent* matter in the part, in which case it is denominated a *suppurating or festered corn.*

This condition is generally accompanied by most acute lameness, and the treatment necessary is usually of a more difficult character, and perhaps I shall find from more experienced members present that it affords room for a divergence of practice. Cases have come

under my observation in which, when the corn *has* been in the suppurative stage, the lameness manifested has only been slight; and these are the kind of cases which not unfrequently prove so troublesome to the veterinarian, as the pus not being allowed to escape below, works its way for an outlet at the coronet, and then we have to encounter one of the most refractory of all foot diseases, viz. a sinuous abscess or quittor.

According to the teachings of "Gamgee" and others, corns were described as "horny tumours." This description would not coincide with our teaching at the present day, for during the period that I have been connected with a large stud of horses—and I might say that I rarely fail to make an examination of each case of lameness that happens—I have only come across two cases that merit this appellation. On each occasion these tumours were completely embedded in the sole, and on carefully cutting around them they appeared quite detached, and were easily removed; in size they resembled a small hazel-nut, but somewhat pointed at both ends; on transverse section they presented an outer covering of horn, the interior being filled with a kind of caseous material, and to the best of my recollection I found them in the *hind* feet, exactly at the seat of corn. The predominant situation of corns will be found to be in the *front* feet, and the inner angle of the foot is more frequently affected than the outer. Cases of corn in the hind feet are of somewhat rare occurrence.

Admitting that the shoe is usually the offending body either by careless fitting, or by allowing it to remain on the foot too long; it is also possible for a stone or gravel to become lodged between the shoe and the sole and produce the same result.

A shoe being improperly shaped or carelessly put on might produce a corn, by preventing a necessary amount of yielding of the sole under the weight or force applied upon it during action.

The fact of the fore feet being almost exclusively subject to this kind of injury is partly to be accounted for, in the London van horse, because, having to do a considerable amount of fast trotting, it is absolutely necessary that the fore shoes be kept *short* and closely *fitted* at the heels. The fore feet, too, have to support a much greater weight, which in action is thrown directly upon them; and this, with the fact that the inner angle of the foot is always weaker than the outer, is a sufficient explanation for the prevailing locality of corns.

Other causes in the production of corns, are, bad conformation of feet. I have noticed that those with flat, full soles, and low, weak heels, are most susceptible.

I attribute the rarity of corns in the hind feet in a great measure to the extra length the shoes can be fitted at the heels; in fact, their occurrence in the hind feet, in cases that have come under my observation, have, generally speaking, been the result of shoeing with a *feather-edged shoe.*

Before completing these comparatively superficial remarks upon

so important an injury, I should like to submit for your observation and discussion, the fact that it is by no means uncommon to find a corn accompanied by a sidebone. To my mind this seems rather difficult to account for, unless we fortify ourselves with the hypothesis that those conditions and conformations of feet which are predisposed to the one, are equally so to the other.

Sandcrack.—This term as applied to a disease of the foot would naturally be understood by the uninitiated to mean a *crack* caused by or containing *sand.* This of course sounds rather ridiculous when we consider the nature of the affection as applied to the foot of the horse, and remember that it is, practically speaking, confined to those horses which have to encounter the stone paving in our large towns. "Percival" suggests that the word *sundered* substituted for *sand* would be more comprehensible, and to all intents and purposes a better definition, and in this we may agree. Sand is a comparatively scarce material, certainly much more needed in some parts of our London streets.

A sandcrack, using the ordinary acceptation of the term, may be described as a longitudinal division to a greater or less extent of the horn-fibres of the wall of the hoof, as a rule commencing at the coronet, and extending downwards either in a straight or zigzag fashion. It may be found in any part of either fore or hind foot, but more commonly is it noticeable at the front part of the *hind*, and the sides or quarters of the *front* feet. It is usual for a "quarter crack" to assume a more slanting direction than one occurring at the front of the foot, owing to the horn-fibres taking a more oblique course. The crack may consist of a simple cleft of the horn-fibres, involving the sensitive structure only at the juncture of the horn with the skin, or it may assume a much more serious aspect, and the separation extend so deep as to implicate the sensitive laminæ, in which case the inflammation resulting generally terminates in the suppurative process; and if this is not shortly relieved from below, the pent-up matter will naturally work its way to the coronet, and produce such an amount of tumefaction as to result in a total separation of the horn from the coronary secreting substance. As a sequela we often get malformation of the foot in this particular part, resulting in a permanent eyesore if nothing more serious.

With regard to this particular disease I have not been able to trace any record of its ever occurring to the foot previous to its being submitted to the shoeing-smith, and, as before remarked, it is unusual for the feet to become attacked until they have been subjected to the wear and tear of our hard roads; more especially do I allude to the varying kinds of material at present used in paving the streets in our large towns.

So far as the smith is concerned in the production of sandcrack, it may be occasioned by his fixing the shoe on without getting it well embedded, and so causing an inordinate amount of pressure in any part of the foot; or again, by not sufficiently cutting away the

toe of the foot, thus exposing it to the strain of improper angles. These, together with the concussion, the pace, and the big loads which horses are frequently called upon to draw, are, I think, sufficient to justify my having classified "sandcrack" as being either directly or indirectly attributable to injuries. It is well known that horn is incapable of active disease, being a secreted and not a formative material, hence the cause must be an *extrinsic* one.

The wet and dirty condition of the streets is also an important factor in their production. Especially do I allude to this circumstance, because after a horse has so far recovered from the lameness attending the original crack as to be fit for work, so sure will the dirt and moisture work its way in and so re-open the fissure and make the horse as lame as ever for a few days.

Amongst natural causes the insufficiency of horn secretion in any part of the foot would have a great tendency to result in a sandcrack. Horses with upright, blocky feet I have found more predisposed to TOE sandcrack, and those formations which I have previously noticed as more liable to corns, are in my opinion also susceptible to QUARTER sandcrack. It is by no means an uncommon coincidence for a sandcrack to supervene upon a severe tread or other injury to the coronet, and when arising from this cause, I have found them the most difficult of any to deal with. Another description we frequently encounter as a cause of lameness, and what I have chosen to designate as

Sandcrack of the Sole.—This I think I am justified in saying has never been expounded by any of our writers on foot lameness; it certainly cannot be said to be anything new, and possibly might have been classified by authors under the heading of "Bruises to the Sole." But when we come to notice the characteristic features in connection with this as compared with a mere bruise, a marked deviation can be observed: for instance, it is invariably found around the sole that comes in contact with the shoes, consequently so far as the shoe is concerned in producing the other kind of sandcrack, so it must be admitted that the shoe is equally productive of the kind at present under consideration. On a careful examination of the foot, after the removal of the shoe, in order to discover the exact part of the foot where our search for the cause of lameness is to take place, nothing will be noticeable, except the flinching of the horse when the sole is tapped with the hammer or squeezed with the pincers; but on removing the sole with the drawing knife a distinct black mark will be found, which will reveal upon close observation nothing more nor less than a split in the sole, analogous in every particular to the crack common to the wall. A minute search of this must be made, until the pent-up matter, which I might say is invariably present, is allowed to escape: in colour the pus resembles and is almost identical with that found to accompany a prick in shoeing, consequently considering that these cracks or splits are always found in the immediate vicinity of the nail-holes, a certain amount of discretionary

skill is required in order that the lameness may be attributed to its proper cause. This is one more instance in which the presence of the veterinary surgeon is imperative, in order to prevent undue blame being attached to the shoeing-smith. Misconception in these cases might very easily arise where parties concerned are disposed to accept an unskilled opinion—sometimes resulting in danger to the proprietor of the forge not only of losing a shoeing contract, but also of being involved in other ways which would probably prove even more disastrous.

Treading on the Clip.—This is also a frequent cause of serious and prolonged lameness, and may arise either from the shoe being actually thrown, and the horse's foot coming in contact with it, or, as is more generally the case, the shoe becomes loose from the breakage of some of the nails or otherwise, and allows sufficient space for the clip to become embedded in the foot, and so lame the animal. The wound, on searching with the knife, will be found to present a dark appearance, and to correspond with the size of the clip ; and when it is the result of the shoe becoming loose *only*, it will be noticeable at the juncture of the sole with the crust. If the injury is caused by a thrown shoe *any* part of either the frog or the sole may be the subject of the injury. It is not unusual for a portion of the clip to break off in the foot, so when an examination of the shoe that caused the injury is impossible, a thorough search of the wound should be made, with a view of detecting any broken pieces that might be in the foot.

Should the pedal bone become injured—and this is by no means an uncommon occurrence—the case must be looked upon as serious, and some weeks will elapse, even under the most favorable circumstances, for the exfoliation of the piece of injured bone to take place.

On carefully recording these cases of injury it will perhaps appear rather astounding to you that damage of this description to the pedal bone is much oftener attended with more successful results than when this bone is the recipient of an injury from any other source. This is, to a certain extent, proved by the rarity of a specimen of this kind of injury.

Malformation of the coronet is not an unfrequent subsequent effect. This is likely to arise when the suppurative action attending takes an upward tendency, in spite of every attention, and relieves itself by the formation of an abscess, which, after the healing process has subsided, leaves such an amount of thickening as to depreciate the animal's value, if not also its future usefulness.

Picking up Nails.—This is, in my opinion, of even more importance than any of the others, and is of much more frequent occurrence than one would imagine. The horses which comprise the studs of our large railway companies, carriers, and contractors, working in and about the City, the docks, and the numerous depots, where packing-cases form a large proportion of consignments, are especially liable. From the different kinds of specimens I have laid

before you, which are not only various but somewhat curious, you will see that the streets have contributed not only nails, but such articles as bolts, screws, flint stones, and pieces of broken bottles, which the horses' feet gather during their travels. This kind of injury is one of the greatest pests which we, as London veterinarians, have to contend with. It not only entails a large amount of suffering to the animal that is unfortunate enough to have its foot so damaged, but the actual loss annually accruing to our large horse owners is so enormous that it is next to impossible to estimate, and, forsooth, it is not in our power to prescribe a remedy.

The specimens, which are very numerous, have all been taken from horses' feet within so short a period as the last six months, a fact some of you will no doubt consider almost incredible. The predominant description, you will observe, is what is known as the ordinary *French nail*, such other miscellaneous articles as bolts, various pieces of broken iron, flint stones and glass, mutton-chop bones, ordinary toilet pins—and in one instance within my recollection, the prongs of a dinner-fork—are more uncommonly met with, but are equally productive of serious lameness. The extent of the lameness resulting naturally depends upon the part of the foot penetrated and the extent of the penetration. The only parts of the foot subjected to these injuries are the sole and the frog, but the latter, on account of its exposed situation and softer texture, is more susceptible than the sole. The usual spot for gathering these foreign materials, and especially *nails*, I have found to be within about an inch of the point of the frog, and generally in the commissure existing between the sole and frog. All the four feet are unquestionably liable to injury by these agents, but on carefully recording such cases it will be noticeable that the hind feet oftener suffer than the front, and this, in my opinion, may be satisfactorily accounted for by the *slipping* of the hind feet during the time the horse is in the act of backing his load to the required position in the different goods depots or warehouse yards.

The success attending upon the treatment of these cases depends in a great measure upon the length of time the nail or other object has been in the foot previous to being detected. Cases have come under my notice where tetanic symptoms have developed themselves before any attention whatever has been paid to the foot; the nail only causing slight lameness, the careless stablemen no doubt thinking it would pass off if the horse was allowed a day or two's rest. The seriousness of the case depends, of course, upon the extent of the injury to the sensitive structure of either the sole or the frog. Concerning punctures to the latter, I have known a nail even to penetrate so deep as to actually damage the navicular bursa, but these cases fortunately are of rare occurrence. As regards punctures of the sole, these, as above stated, are much less frequent, but when found it is not uncommon for the pedal bone to become involved in the damage done. When such vital and important structures as the bone and the bursa are implicated

such cases must be looked upon as of long duration, and are, as a rule, very obstinate and tedious to deal with.

The lameness resulting from the presence of a picked-up nail is often peculiarly indicated, the horse suddenly snatching up the foot after its coming in contact with the ground. A leather sole is not always a certain preventive or safeguard against the foot being injured in this particular way, as I have come across two cases within the last six or eight years where the nail actually passed through the leather, and punctured the frog to a considerable depth.

Having now completed the very brief, and I am afraid rather uninteresting description of the most common injuries that happen to the foot of the horse, I think my endeavours to absorb your interest would be even more incomplete if I closed this paper without commenting a little upon the

Treatment.—I do not anticipate that I shall elicit anything out of the common in the details of my treatment, but an interchange of ideas upon any practical or scientific subject often tends to enlightenment, and encourages us to adopt other remedial measures than those to which we have so long been accustomed. It should be our utmost endeavour, not solely to maintain our professional reputation, but to strive for the alleviation of suffering to which the animal under our care may be subjected, and at the same time to study the by no means unimportant factor—the interests of our client.

The treatment necessary for all foot cases is based upon the following settled rules of action, viz. remove the cause; relieve the pressure; give exit to matter; and—most essential of them all—expedition.

It is not usual for the veterinary surgeon to undertake the active part of removing the shoe and cutting out the foot, but it is nevertheless indispensable that he should be capable of performing this act if occasion require him to do so, therefore a good "smith," either in his employ or otherwise, should be at hand to carry out this duty. It is absolutely necessary that the tools requisite should be kept in workmanlike condition; blunt knives not only tend to excite the operator's temper, but prevent him carrying out his search quickly and skilfully. Three or four sharp foot searchers varying in sizes will be all that is wanted, so far as instruments are concerned. Of course the paring away of horn depends upon the amount of relief required, but my experience has taught me that the more conservative we are in this respect the better.

The treatment necessary for a "corn" is, generally speaking, simple, and in the majority of cases of short duration and very effectual. It is, I think, an acknowledged fact that the corn must be well cut out with the view of ascertaining whether or not pus exists there; if not, and the lameness is only slight, I have adopted the plan of not applying a poultice at all, but simply removing the exciting cause by having the shoe cut in the manner shown in

specimen, and at once put on with a leather sole, when in nine cases out of ten the lameness will disappear after twenty-four hours' rest, and the horse is fit for work again.

But when the corn is in a state of suppuration, it will be found necessary to poultice it for about two days, after that allow the foot to remain bare on a peat-moss bed for a similar period, and in the meantime dress it with the ordinary white lotion, which I have found to be more efficacious than any other kind of foot dressing. Then apply the shoe and leather as represented, when you may expect in the majority of instances to have your horse fit to resume work again.

The treatment for the next foot injury, viz.

Sandcrack, is, I shall possibly find from your criticism, of a more questionable character. But I can only relate what I have found after many trials to be the most reliable and successful. I repeat that, as with corns, it is unmistakably necessary that the crack should be thoroughly cut out. The kinds we have to encounter are very often in a festered condition, and if a means of escape is not quickly found for the matter it will, with the assistance of poulticing, soon find an exit for itself in an undesirable situation.

I have often consulted practitioners from provincial towns, and they say that it rarely happens with them that such an amount of cutting and paring is necessary. To this I can only add the remark that the cases we meet with in London are more serious than those found in other towns. This is perhaps not difficult of explanation, at least amongst that class of animal which is more especially the subject of my paper, viz. vanners.

A certain amount of restriction should be put upon poulticing sandcracks, two or three days in my opinion being quite long enough; then after allowing the foot to get hard, put on a leather sole and a shoe with side clips, as represented in specimen; further rest and an occasional blister of the coronet will materially facilitate the growing down of the horn, which is, I believe, supposed to grow at the rate of about a quarter of an inch a month. When this has taken place, and the horse can withstand the jar of the stones, I have a nail inserted transversely to the crack and clinched in the ordinary way. (Specimen exhibited.) The cutting away of the toe as defined in the specimen has also a useful tendency in assisting the object of the nail, *i. e.* in keeping the crack together.

The treatment essential for the other kind of injuries I have quoted—treading on the clip, picking up nails, &c.—needs very little further comment. The application of poultices to the feet so injured I advise should be of as short a duration as possible. Of course when our case does not respond in the way we generally expect it to do, we may then conclude that we have to deal with damage to the bone. These are fortunately somewhat rare cases, and no fast rule can be laid down.

In conclusion, I should like to make just a few remarks upon a

particular kind of shoe that is very frequently adopted in cases of foot lameness, and imagined by some to be unequalled in supporting and guarding the foot, and this is the

Bar Shoe.—It is a shoe that has been handed down from generation to generation, and upon this simple fact alone I am inclined to think rests the only reason for its almost universal adoption, without any consideration whatever whether an ordinary plain shoe upon being properly adjusted should not be equally effectual. So far as I am concerned, I have not used a bar shoe for the last five years, having been able to so manipulate an ordinary plain shoe that, in conjunction with a leather sole, it should, I think, always suffice for any kind of foot. A bar shoe is not only unsightly but unnecessary in my opinion, for the frog if protected by a leather sole is quite capable of sustaining itself against all wear and concussion, without afflicting it with a bar of iron, which only labels the foot and attracts the attention of all outsiders. Of course it will no doubt be said that bar shoes are absolutely indispensable for some conditions of feet, but so far as my experience goes, I am inclined to make the somewhat appalling assertion when such is the case that the horse is more valuable to the "knacker" than to his "unfortunate owner."

At its conclusion—

Mr. Elworthy said he thought pricks in shoeing were to a great extent due to the employment of inferior men; in his own establishment, where some of the farriers had been at work for twenty-five or thirty years, they rarely pricked a horse, and he was certain that with responsible and experienced farriers this kind of thing would not often occur. In his experience "corn" was rare in the hind feet. As to "sandcrack," he did not see the necessity of opening the foot to the great extent advocated by the essayist, for he found with rest and a blister to the coronet the lameness usually disappeared. He was certain horses derived great benefit from the use of the bar shoe, and it was as good a thing as could be devised for keeping "old crocks" going.

Mr. Alfred Broad had no doubt but that "sidebones" predisposed to corn. He had known many instances in which the appearance of an abscess at the heel was the first indication of the presence of a corn, the horse having previously shown no lameness. In sandcrack he had not found it beneficial to open the crack by cutting away the horn, and had known intense pain and death arise from this proceeding, but he agreed that if poulticing did not afford relief the best course was to blister the coronet.

Mr. Caton had known portions of the pedal bone exfoliate and the horse recover; he bore testimony to the great loss of life and services from horses picking up nails and such articles, and advocated the use of a plated shoe, *i. e.* a removeable piece of thin iron instead of leather soles, for he found leather for this purpose very little good, being so often perforated by pointed articles. He was a great believer in soaking and poulticing injured feet, and also

in the bar shoe, which, although it might be old-fashioned, he liked very much. With reference to corns, he thought there were very few horses with "sidebones" that were not the subject of corns, and he also thought that corns were more often caused by sidebones than *vice versâ*.

Mr. Roots found that where six pricks in shoeing used to occur he now only got one; this, in his opinion, was due to the great improvement in the quality of nails. He now used only machine-made nails, and he preferred the brands known as the "Lion" or the "Star." In the treatment of corns he advocated the use of a three-quarter bar shoe; he had never seen a sandcrack of the sole, but he remembered the case of a horse with a fissure at the point of the toe, which occasionally gave rise to lameness as long as the animal lived.

Mr. Hunting said that only that very day he had heard a fact illustrative of the importance of horseshoeing: a certain firm, by economy in their farriers' wages and in horseshoeing generally, saved some £1200 a year, and thought they had done great things; but "quittor" and all forms of foot lameness increased, and a little calculation showed them that instead of saving £1200 per annum they had lost something like £3000 worth of horses since their altered style of shoeing was started. It was true machine-made nails had been of great benefit; this was not the case, however, with machine-made shoes: they were nearly all unevenly holed, so that the farrier could not properly direct his nail. He was at a loss to understand why engineers who were now so skilful could not turn out horseshoes with evenly made nail-holes. Mr. Rogerson had alluded to the practice of workmen trying to screen themselves in cases of pricking; some men were extremely hasty with farriers, and thought for a horse to be pricked was an unpardonable sin, but he had generally found such men knew nothing about horseshoeing. He held a man should not be blamed unless his carelessness was proved; and a man who, having pricked a horse, went and told his employer ought to be excused. "Pricking" was a question which often cropped up in law courts, and it was a debatable point as to how long a horse might go after being "bound" or "pricked" without showing lameness; he knew that a horse having been bound in one or two nails might not show any lameness for ten days after he had been shod. He agreed that the "Star" and the "Lion" nails were excellent, but there was another brand, the "HP," which as an Englishman he should like to say was the best. He had noticed that the speakers who had told them that sidebones accompanied corns were gentlemen whose practice lay with heavy horses; personally he knew little about heavy horses, but in other classes he had not found this to be the case. It was possible to produce a corn by leaving the foot uneven; as a pupil of Gamgee he repudiated that that gentleman had ever taught that corns were horn-tumours. He (Mr. Hunting) believed that corns were produced by shoeing only. Neither did he believe in the old adage, "Once a corn, always a corn," although it

was pretty nearly true if the corn had been in existence any length of time. He questioned whether they ought not, as a Society, to take some practical notice of the question of "picking up nails;" when they came to consider that in one firm alone during the last six months 200 French nails had been found in the feet of horses, it pointed to the necessity of some steps being taken to keep the streets clear of such articles, for it showed great negligence on the part of those who pulled packing-cases to pieces.

In the treatment of foot cases Mr. Rogerson had rightly pointed out that expedition was greatly to be desired, and that he meant the early detection and the early treatment of the injury.

He, the speaker, believed that poulticing in foot cases was generally much overdone; a great deal of mischief arose from pursuing this treatment after the "matter" had escaped. Mr. Rogerson had made a very sweeping assertion on the question of bar shoes, but if he had men clever enough to fit ordinary shoes on all diseased feet he was quite right in making his assertion. Bar shoes might not be handsome, but what did that matter if they were useful? In the north of England the "Patten Shoe" was much used in those cases of lameness where the horse when at rest elevated the heel of his foot from the ground; this was equivalent to raising the ground up to his heel, which was just the position the horse was doing his best to avoid. He thought in the paring of feet the more conservative they were the better; he knew men of great experience in foot cases, who cut and mutilated the feet a good deal. Surely this was not good surgery; one could nearly always tell as to the presence of pus in the foot without paring out every nail-hole. As to sandcrack, he differed from the essayist's opinion that it should be cut out; if suppuration and great lameness had not occurred why cut it out? If they did so they must also adopt Mr. South's plan—put something in the part again to prevent the clips of the shoe drawing the foot together and pinching the internal structures. A block of wood should be put into the cavity, so as to prevent any movement of the hoof.

Mr. Wragg having expressed his regret that he, being unavoidably late, had only heard the concluding portion of the paper, said that it was more often the fireman than the doorman who was to blame for horses being pricked; as a rule, when a horse was pricked, the nail-hole of the shoe was defective, although personally he always found fault with the doorman for trying to drive a nail with such a shoe. As to machine-made nails, there was no doubt they were much thinner than hand-made ones, and, in addition, they were polished and free from rust, which was undoubtedly beneficial. In the treatment of sandcrack he always adopted Mr. South's plan, and with very good results. He cut out the sandcrack whether there was pus or not, but if there was pus he would not put in the wooden plug for the whole extent of the crack, but would temporarily insert a short plug at the lower end of the fissure, and then poultice and otherwise treat until all suppuration had ceased, when he would have a plug inserted the whole extent of the crack. This plan of

treatment was very efficacious. It was not in his experience that horses with sidebones invariably had corns, and he thought there was very little connection between the two diseases. In the treatment of suppurating corns he used a three-quarter shoe, but in some cases, as also in other diseases of the foot, he was a believer in the utility of bar shoes. The old theory quoted by Mr. Hunting—"Once a corn, always a corn"—had long been exploded.

Mr. Stanley had great faith in poultices for injuries to the feet. Corns were not in every case the result of shoeing or concussion on hard roads, for he once knew of an unshod colt suffering from corn.

After a few remarks by *Mr. Villar*, in which he complimented the essayist on the practical way in which he had dealt with his subject, *Mr. Slocock* said, although he had never seen corns in an unshod colt, he had seen "sandcrack," and he thought that some animals had naturally a weak kind of horn which was predisposed to troubles. In the treatment of foot cases he believed in the use of poultices until the horn was thoroughly soft.

Mr. Rowe had for many years used a modification of the "Patten Shoe;" the bar of the patten, instead of having a straight ground surface, was convex from heel to heel. This shoe was especially useful in "wricked fetlocks." As to the length of time which may elapse before a horse showed symptoms of lameness after pricking, he found that if a horse was tightly bound with the nails not many hours would pass before it gave rise to lameness; usually it occurred within three days after a prick, but of course at times lameness did not supervene for eight or nine days after. They could not get away from the fact that a case of pricking might occur in anyone's forge at any moment; one had to entirely rely on workmen, and the present underselling in the horseshoeing business was a mistake and conducive to pricking.

The *President*, remarking the lateness of the hour, called on the essayist to reply, and *Mr. Rogerson*, after thanking the gentlemen for so readily entering into the discussion of the subject he had introduced, proceeded in an able manner to answer the points which had been raised by the various speakers.

On the motion of the *President*, seconded by *Mr. Caton*, a hearty vote of thanks was unanimously accorded the essayist.

It was announced that at the next meeting Mr. Caton would in a short paper introduce the subject "Influenza."

SOUTH DURHAM AND NORTH YORKSHIRE VETERINARY MEDICAL ASSOCIATION.

A MEETING of this Association was held in the North-Eastern Hotel, Darlington, on Friday, December 13th, 1889; Jno. Nettelton, Esq., President, in the chair.

There were also present Messrs. Peele, West Hartlepool; Pickering, York; Nash, Richmond; Stevens, Briggs; Gelsthorpe and Axe, Darlington; Peele, Durham; Nicholson, West Auckland; and Awde, Stockton-on-Tees.

The minutes of the previous meeting were confirmed.

An interesting case of fractured humerus was brought forward by Mr. Pickering.

The Committee appointed submitted the rules they had drawn up, which with some slight alterations were adopted and ordered to be printed. The discussion of the President's address was carried on by all the members present, after which the President replied.

Mr. Pickering then introduced the subject of "Pupilage and Practice" for discussion, but it was decided to hold it over for another meeting.

NEW MEMBERS OF THE PROFESSION.

AT a meeting of the Court of Examiners of the Royal College of Veterinary Surgeons held in London on and between December 17th and 20th, 1889, the following students from the Royal Veterinary College passed their *Oral and Practical Examination*, and were admitted members of the profession:

Mr. M. W. Gatward	
— R. C. Bullen	
— A. H. Sugden	
— W. B. Gridley	Sudbury, Suffolk.
— H. S. Eglington	Walsall Road, near Lichfield.
— E. C. Storey	Holloway, N.
— R. Halpin	
— W. A. Stainton	Hornsey Road, N.
— S. J. Williams	
— J. B. Pier	Uckfield, Sussex.
— C. C. Nasling	Debenham, Suffolk.

Mr. J. J. Brown . . .	Ormskirk, Lancs.
— E. R. Edwards . .	Outwell, Wisbech.
— J. F. B. Moody . .	Leamington.
— H. H. Hide . . .	Lower Edmonton.
— P. W. Creagh . .	
— A. Perkins . . .	Oakley Square, N.W.

The following students passed their *Second Examination*:

Mr. G. Upton.
— D. C. Climeley.
— J. W. Hopkins.
* — T. N. Davis.
— G. A. Wickett.
* — H. A. Pattison.
— S. Bennett.
— R. Forshaw.
— E. W. Bovett.
— G. D. Thomas.
— J. E. Tooth.
— E. B. Robinson.

Mr. J. R. Robins.
* — R. E. Taylor.
* — T. F. Prime.
— P. Easte.
— F. W. Garnett.
— T. W. Hindle.
— J. H. Skelton.
— H. W. Leech.
* — P. Perkins.
— H. H. Truman.
* — R. Wilks.
— W. Scales.

Mr. H. Sharpen.

The following students passed their *First Examination*:

Mr. G. W. Chater.
— E. W. Morris.
— W. Lindley.
— H. Green.
— P. B. Godfray.
— H. C. Welch.
* — A. Stevens.
— E. J. Thorburn.
— A. E. Oliver.
* — F. W. Smith.
— J. Osborne.

Mr. J. T. Priestner.
* — S. A. Nye.
— W. G. Pakeman.
— A. E. Prudames.
— H. Bidlake.
— R. W. Cooper.
— A. J. Lane.
— H. E. Taylor.
— G. S. Harris.
— F. W. Evans.
— J. C. Everest.

Mr. E. P. Barry.

ARTHUR W. HILL, *Secretary.*

GLASGOW VETERINARY COLLEGE.

THE Christmas examinations of the Royal College of Veterinary Surgeons were conducted within this institution on the 12th and 16th ult. The Board of Examiners included—

* Marked thus, passed with *Great Credit.*

Sir Henry Simpson, J.P., F.R.C.V.S., Windsor ; George Fleming, LL.D., C.B., &c., London ; Mr. J. Roalfe Cox, F.R.C.V.S., London ; Mr. Pritchard, M.R.C.V.S., London ; Mr. Duguid, F.R.C.V.S., London ; Mr. I. Vaughan, F.R.C.V.S., London ; Mr. George A. Banham, F.R.C.V.S., Cambridge ; Mr. B. Cartledge, F.R.C.V.S., Sheffield ; Mr. J. Freeman, F.R.C.V.S., Dublin ; Professor Hamilton, F.R.C.S.E., F.R.S.E., Aberdeen ; Professor Yeo, F.R.C.S., London ; Professor M'Kendrick, LL.D., F.R.S., Glasgow ; Professor Almond, Cirencester College, Cirencester ; Mr. W. B. Walters, F.R.C.V.S., Aldershot ; Mr. T. H. Simcocks, F.R.C.V.S., Drogheda ; Mr. Thomas Campbell, F.R.C.V.S., Kirkcudbright ; Mr. Finlay Dun, F.R.C.V.S., Edinburgh ; Professor Heaton, F.C.S., F.I.C., London ; Mr. H. Olver, F.R.C.V.S., Tamworth; Mr. W. Woods, sen., F.R.C.V.S., Wigan ; and Mr. Richard Rutherford, F.R.C.V.S., Edinburgh.

There were also present as *ex officio* members—
Principal M'Call, F.R.C.V.S. ; Professor Cooke, F.C.S. ; Professor Limont, M.A., M.B. ; and Professor Ferguson, M.R.C.V.S.

The following gentlemen passed the first (or theoretical) part of the Final Examination :—Messrs. T. Gorecki, Glasgow ; W. Walsh, Glasgow ; H. Potts,* Glasgow ; James M'Dougall, Helensburgh, Dumbartonshire ; and C. J. Dunn, Glasgow.

The following gentlemen passed the second (or practical) part of the Final Examination, and succeeded in obtaining the diploma of the Royal College of Veterinary Surgeons :—Messrs. H. Potts,* James M'Dougall, and C. J. Dunn.

The following students passed the "B" or Second Professional Examination, viz. :—John Meikle, Stranraer, Wigtownshire ; F. J. Boyle, Ballymoney, co. Antrim ; A. Milligan,* Dalbeattie, Kirkcudbrightshire ; and R. P. H. Dalglish,* Govanhill, Glasgow.

The following students passed their "A" or First Professional Examination, viz. :—H. M'Connell, Armagh ; H. L. Chambers, Ballynahinch, co. Down ; A. P. Stewart, Dennistoun, Glasgow ; R. Mason, Glasgow ; H. A. Hazeel, Dunoon, Argyllshire ; W. Crowley, Tullagower, co. Clare ; D. P. Harvey, Pollokshields, Glasgow ; and F. T. Barton, Glasgow.

* Marked thus, passed with *Great Credit*.

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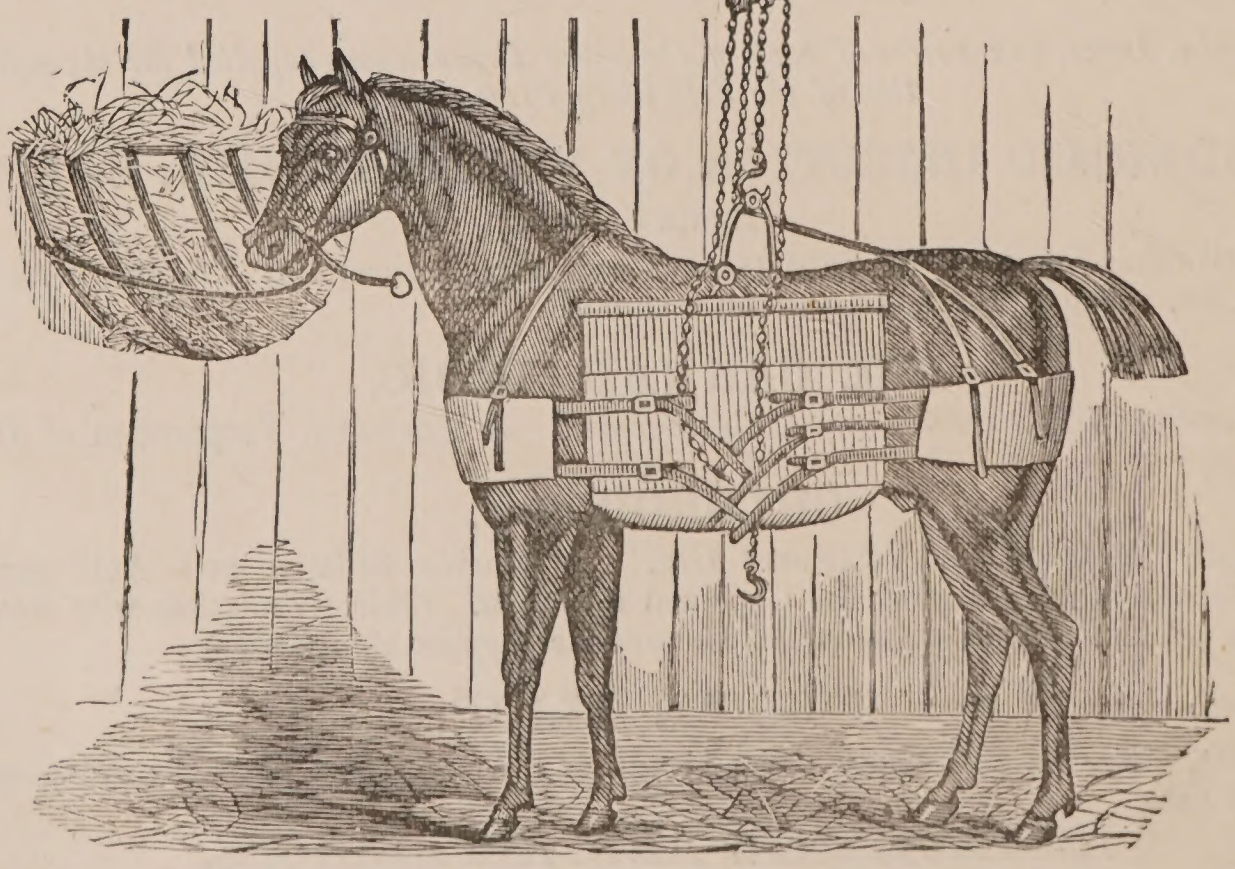

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